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Switchgear Performance

NO link in the chain of plant between the coal pile and the consumer has been more affected by the rapidity of electrical development than has high-voltage switchgear. At the same time, any failure of switchgear under the increasingly severe conditions that are being imposed upon it (despite an upward trend in the inherent impedance of alternators and transformers and the discreet use of reactors) may have more serious consequences than those attributable to the defects of any other piece of apparatus.

During recent years the growth in size of power-stations and the prevalence of interconnection have made the energy liberated under short-circuit a decisive factor in the choice of circuit-breakers. Yet it was only a few years ago that the ratings assigned to the rupturing capacity of heavy-duty switchgear were to be regarded as figures of relative merit rather than as absolute values.

Before then volts and amperes were almost the only characteristics considered. There has been little difficulty in meeting the requirements for higher voltages, but current-carrying capacity and the electro-mechanical forces associated with it are once more raising questions that cannot always be answered by switching at higher voltages.

More recently the importance of the efficient making, as well as breaking, of a faulty circuit has been recognised. The closing of an oil switch is not so likely to happen at zero pause of current as is its opening, but even interruption does not always occur under optimum conditions at all loads. Ability to break circuit at zero current is related to the steepness of the restriking voltage wave, and only the recently developed cathode-ray oscillograph, owing to its negligible inertia, can record the high frequencies (perhaps 100,000 cycles per second) that may be encountered.

The need for short-circuit testing plant was not met in this country until the establishment of the Reyrolle installation at Hebburn (described in our issue of May 30th, 1930), following some useful, but comparatively small-scale, investigations by the Electrical Research Association at Carville. On January 10th last we were able to give some particulars of the testing plant of Associated Electrical Industries, Ltd., at Old Trafford, and this week we include an article on the Witton high-power testing laboratory of the General Electric Co., Ltd. This station, for which practically all the equipment was manufactured in the works, gives Great Britain the third plant of its kind, and puts it well ahead of other countries.

It has already shown that, although methods based upon calculation and extrapolation left something to be desired, since they could not allow for the possibility of critical conditions being introduced outside the range of actual observation, the earlier designs were remarkably close to the ideal.

While it is right that the user should feel confident that his switches are of a type that has been proved under the most onerous conditions, it is still more to the point that such tests provide fundamental information to designers that will enable them to prepare for developments that are likely to be as great during the next few years as in the past decade.

Lord Ashfield on Distribution

LORD ASHFIELD'S speech to shareholders of the North Metropolitan Electric Power Supply Company went one better than the average chairman's review of a year's events. It covered certain matters of the moment in an informative, practical manner, such as the capital cost of distribution works in urban and rural areas and its effect upon the actual cost of electricity to the consumer. The company has supply powers for an area of 674 square miles, one part of which is purely urban in character and the other almost wholly rural. The population of 821,000 is very unevenly distributed, varying from a density of 5,060 persons per square mile in the urban part to only 310 in the rural section. Lord Ashfield said that in such an area it was the cost of distribution rather than that of generation that determined the final cost of electricity at the point at which it reached

the consumer. He cited the cases of Kingsbury, an urban district with a population of 5,800 per square mile, where the capital cost of distribution mains and sub-stations was approximately £15 per consumer, and the rural area of Stevenage where, with a population of only 179 persons per square mile, the equivalent cost was £54 per consumer, or over 3½ times as much. "The cost of distribution per consumer varies inversely with the density of the population." There seems to be no limit to the expansion in the urban areas of the company, for new building is continuously proceeding, and the low all-in rate and the excellent showroom enterprise and general consumer service given by the company cannot fail to attract business for some years to come. Its ambition is to make a supply of electricity available to everybody within its area and at a common level of charges. With an annual revenue of over 2¼ millions sterling, and so many factors favourable to large-scale development, and above all an enterprising expansion and management policy, the "Northmet" stands very prominent. Undertakings which are not making the headway that they should, feel dwarfed both in size and in opportunity beside it, yet we believe that if their chiefs, staffs, and councillors could visit some of the most live parts of the "Northmet" area at times of intensive activity and examine the business and service methods in operation, they might return to their own areas energised by an all-electric atmosphere, to the general benefit of the industry.

Better Air—Electrically

THOUGH much more important air-conditioning work is being done than generally meets the eye, there is no doubt that the subject has not yet received the attention in this country which the United States has given it—probably due, to some extent, to the different climatic conditions. Nevertheless, it is a matter which possesses great possibilities—particularly for the electrical industry. Electricity is already employed to a very considerable degree for ventilation and heating, considered as quite separate subjects, and the step towards combining the two functions in a scientific manner is therefore quite a small one. An example of what can be done in this way is provided by the Fleetwood Marine Hall (a description of which appears in this week's issue), in which the air is maintained at a comfortable temperature by a plenum system operated by electric fans and air heaters, representing a total load of 182 kW. In addition to this there is a further 80 kW of panel heating, apart from other independent heaters, electric kitchen equipment, and a lavish system of lighting. This represents a desirable load for at least five months of the year, and even for the remainder the ventilation and kitchen plant require a goodly number of units. There must be hundreds of halls in the country which could be similarly equipped.

A Meter Bill

FROM an answer made by Mr. Hore-Belisha to a question in the House last week it appears that Mr. H. G. Williams's Electricity Supply (Meters) Bill has a fair chance of becoming law, although a private member's measure. The Bill, which has been referred to a Committee of the whole House, provides for the appointment by the Electricity Commissioners of meter examiners. Existing meters will be deemed to be "certified" under Sections 49 to 59 of the Schedule to the 1899 Act until they are disconnected and removed. The "appointed day" for the Act to come into force is given as Jan. 1st, 1937. The meter examiners will relieve the "electric inspectors" mentioned in the 1899 Act of their meter duties.

Automobile Electrical Troubles

THE Royal Automobile Club has issued its report for 1935 on the causes of breakdowns of motor vehicles on the roads during the past twelve months, based on figures obtained from its "Get You Home" service. From this it appears that engine ignition trouble not only continues to be far and away the most prolific cause of breakdown, but that the proportion—22.9 per cent. of the total of 13,203 cases recorded—was higher than in any of the five preceding years. The electric lighting equipment of cars, although giving very much less trouble than the ignition, was responsible for 3.1 per cent. of the failures, as against only 2.4 per cent. in 1934. The starting equipment of motor vehicles, on the other hand, was responsible for only 0.8 per cent. of the breakdowns, as compared with 1 per cent. in the previous year. No separate mention is made of automobile batteries. Although most of the electrical troubles experienced with modern motor vehicles may be due to lack of attention on the part of their owners or drivers, the fact that the lighting, starting and ignition are, together, responsible for over 25 per cent. of the recorded breakdowns is a matter which ought to be taken into serious consideration by the manufacturers of both cars and of electrical equipment. It has been suggested that the latter are not entirely to blame, but that in the quest for bigger and bigger outputs and reduced costs they are being forced by the vehicle manufacturers to supply goods more on a price than a quality basis, a state of things which is deplored by the majority of motorists.

Promoting Road Safety

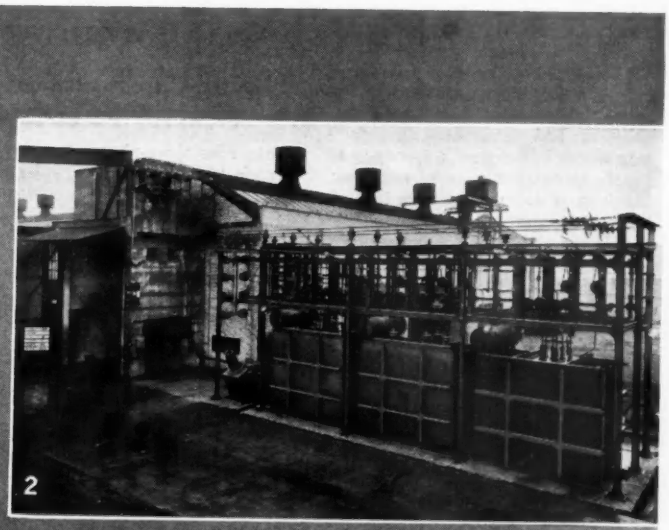
THE discussion of the paper on the high-pressure mercury-vapour lamp in public lighting, which Messrs. G. H. Wilson, E. L. Damant and J. M. Waldram presented before the I.E.E., provided a welcome indication that illumination of our streets is progressing steadily in status from an art to a science. Something more than luminous efficiency must be held to account for the growing popularity of the discharge lamp during the past three years. Probably improvement of driving conditions due to sharpness of silhouette, to which Professor E. W. Marchant referred, has been largely instrumental in backing its claims. The mercury-vapour lamp has also effectively demonstrated, by contrast, that glare is most noticeable on poorly lighted roads. More important than anything else, however, is the way in which the design of fittings and the planning of installations have followed so closely the increased technical efficiency due to the development of the lamp itself.

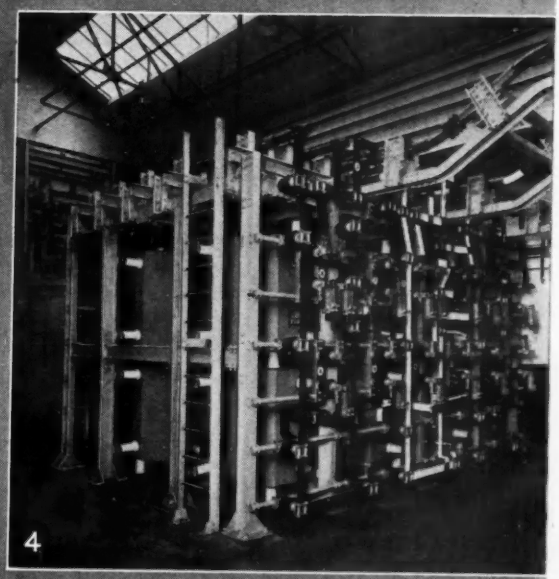
Very Low Temperatures

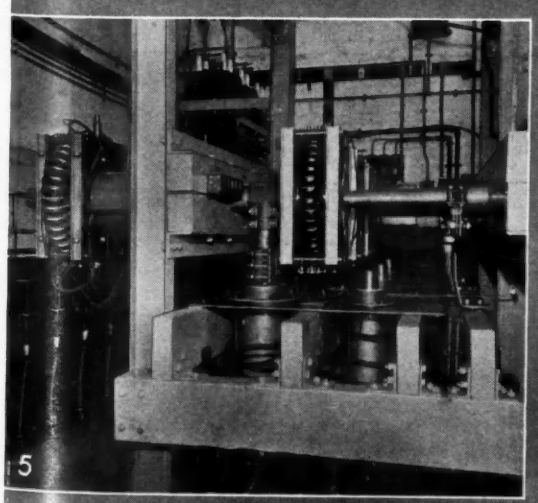
THE electrical bearing of the quest for very low temperatures is manifold. First there is supra-conductivity, the state which occurs at critical temperatures when the electrical resistance of conductors (but not copper, so far as it is known) and some semi-conductors suddenly becomes nothing. Then the liquefaction of air has made possible the extraction from it of neon, argon and other rare gases used for lamps and luminous signs. For attaining the lowest temperatures electrical means are employed, and most recently a magnetic method has enabled a temperature to be produced of only 0.003 deg. C. above absolute zero. The exhibition opened by Sir William Bragg at the Science Museum, South Kensington, is, we believe, the first of its kind to be held anywhere, and covers the subject in a comprehensive and thoroughly practical manner. Generally it may be said that the line of investigation being followed promises to open up a new field for the study of the properties of substances.

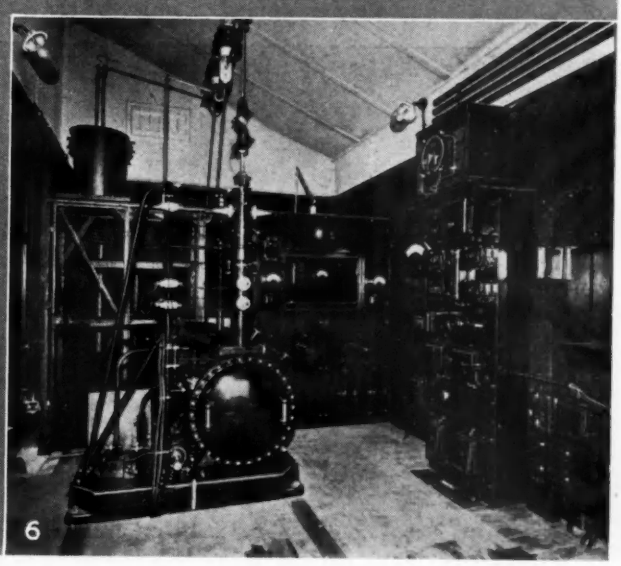
The McGowan Committee

THE MINISTER OF TRANSPORT was not very communicative last week when Mr. Chuter Ede asked him questions about the McGowan Committee on the Distribution of Electricity. Nevertheless, he revealed that the Committee had *not* concluded its hearing of evidence, whereas rumours to the contrary have been circulated, and that it was in frequent session. Mr. Hore-Belisha was unable to say when the Committee's report would be available. So, it seems, we must possess our souls in patience for a further space.









Switchgear Testing Equipment at the Witton Engineering Works **(See next page)**

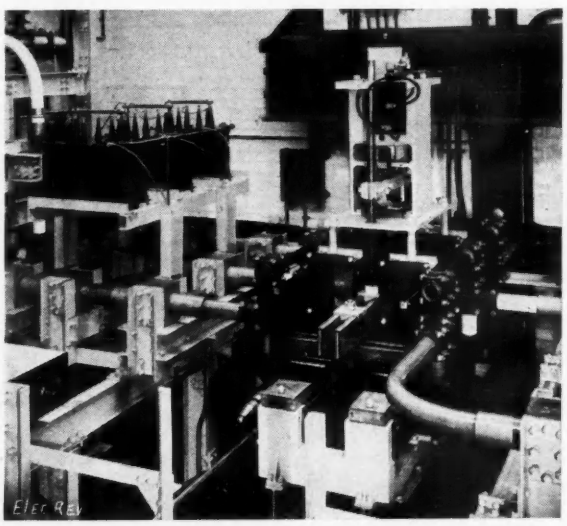
1. The test bay, showing a 1,500,000-kVA oil circuit-breaker mounted ready for testing. 2. Exterior view of the high-power test plant. 3. The control room in the observation house, showing the pendulum which initiates the short-circuit test. 4. The reactors, with knife switches for series-parallel interconnection. 5. Shunts and instrument transformers for operating the oscillographs and protective gear. 6. The cathode-ray oscillograph in the observation house.

High-voltage Circuit-breaker Testing

The new high-power plant of the General Electric Co., Ltd.

THE switchgear laboratory which has been recently completed by the General Electric Co., Ltd., at Witton Engineering Works is designed to produce an instantaneous three-phase short-circuit of up to two million kVA for testing circuit-breakers of from 6.6 kV to 132 kV with rupturing capacities up to one and a-half million kVA. For lower voltages field regulation or a step-down transformer is used.

We have now had an opportunity of inspecting the plant and of witnessing a successful test on a sample 35-kV fuse, which



View of the maker switch (open position); the method of mounting the tubular bus-bars is also shown

the company has developed for 11-kV systems, with a rupturing capacity of 35,000 kVA and 6,000 A. The plant is laid out in neat straight-line sequence and includes a generator room, a test bay and (thirty yards beyond) an observation house which includes control room and oscillograph equipment.

The alternator, rated at 50,000 kVA, has a reactance of 2.7 per cent. and gives a symmetrical short-circuit of 1,850,000 kVA which may be increased by 80 per cent. under asymmetrical conditions. Voltages of 22, 12.7 and 6.6 kV are obtainable by series-parallel connection of the double winding and by star or delta connection at the terminals. A maximum force of 200 tons is exerted on the foundations, which consist of a solid block of concrete 12 ft. deep and weighing 450 tons.

A damping winding in the rotor slots, above the exciting winding, minimises the decrement of the short-circuit and prevents excessive rise of voltage in the rotor winding. To prevent displacement of the stator winding, the insulating tubes are supported where they emerge from the core by wedges that form a solid ring round the circumference of the winding, thus providing a self-supporting arch structure. High-tensile aluminium-alloy (as used in aircraft) is employed for the end shields, which embody a girder type of construction. Ventilation is provided by a motor-driven fan, delivering 50,000 cub. ft. of air per min. The system is automatically shuttered off from the atmosphere in the event of fire and is flooded with CO_2 within thirty seconds.

In order to facilitate starting, forced lubrication at 600 lb. per sq. in. lifts the 22-ton rotor off the bearings; the pressure is automatically reduced to 12 lb. when the rotor begins to revolve. The short-circuit capacity is raised by reducing the decrement of current between short-circuit and arc extinction; this being due to the demagnetisation effect of the armature upon the field, is accomplished by increasing excitation at the instant of short-circuit.

The exciter, which has an 11-ton flywheel, can provide five times the normal field current; resistance grids in the alternator field circuit are short-circuited at the appropriate moment. As an example, at the end of eight cycles from the inception of short-circuit the current may fall to 35,000 A instead of 24,000 A without boost, and the kVA to 570,000 instead of 265,000.

The alternator is driven by a 450-h.p. s.r. motor and the exciter by a 1,500 h.p. s.r. motor. As both motors are disconnected from the source of supply immediately before the short-circuit is applied, the test energy is furnished by the momentum of the rotors.

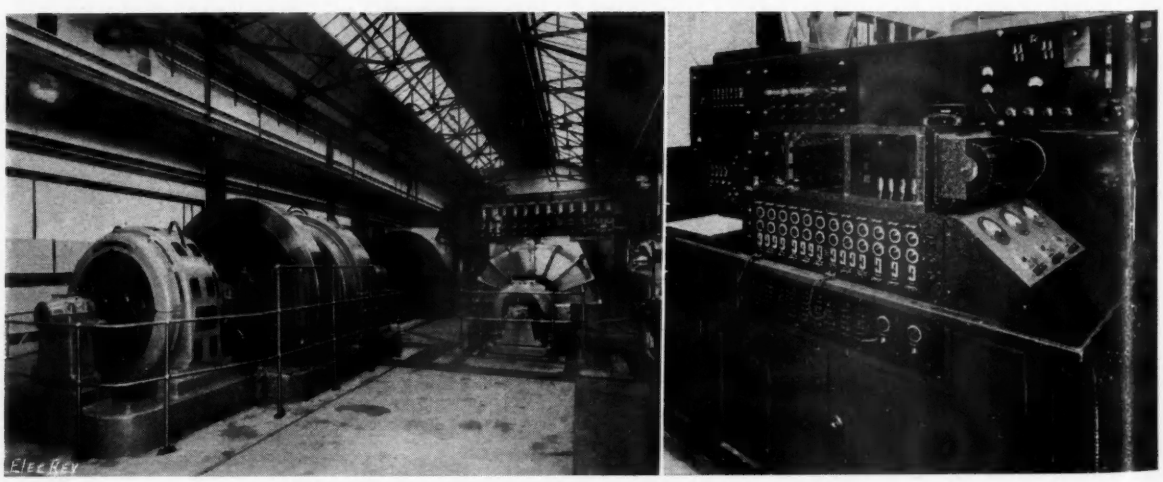
The bus-bars are of 3-in. copper tubing, having an area of 3 sq. in. and supported in air at 5-ft. centres. The force between them may reach nearly one ton per ft. and two tons near the terminals of the alternator and the air-break maker switch. The latter, which is not required to open the circuit, has two breaks per phase and the moving contacts are solenoid opened and spring closed.

A standard 1,500,000-kVA oil circuit-breaker, housed in a ferro-concrete enclosure, has been installed to back-up the switch under test in case it should fail to clear the short-circuit applied. As the breaker tested may be of the same rating, a margin is provided by the interruption of the alternator field before the breaker is opened.

Four one-ohm concrete-enclosed reactors per phase are employed. Each unit is in two halves with a centre tapping for combinations of series and parallel connection, giving a range in practice of from 4 to 0.04 ohms per phase. Liquid resistors are incorporated, but as the power factor can vary from 0 to 0.3 without materially affecting the severity of the test, they will not often be required.

The 50,000-kVA transformers have an inherent reactance of only 2.6 per cent. They are of the air-cooled, outdoor type. Shunts in each phase of the test-bay earth connection are provided for the current elements of the oscillograph; their advantage over current transformers is that they do not distort the current wave. The voltage elements are served by resistance-type potential dividers or potential transformers.

The atmosphere of the test bay is sealed by the closing of the door electrically, leaving the CO_2 or "Mulsifyre" equipment to extinguish any fire. The cylinders of CO_2 in the machine room can also automatically fill the alternator casing or the master-switch cubicle. Protection of the power network is on the McColl system, with auxiliary overload and leakage relay.



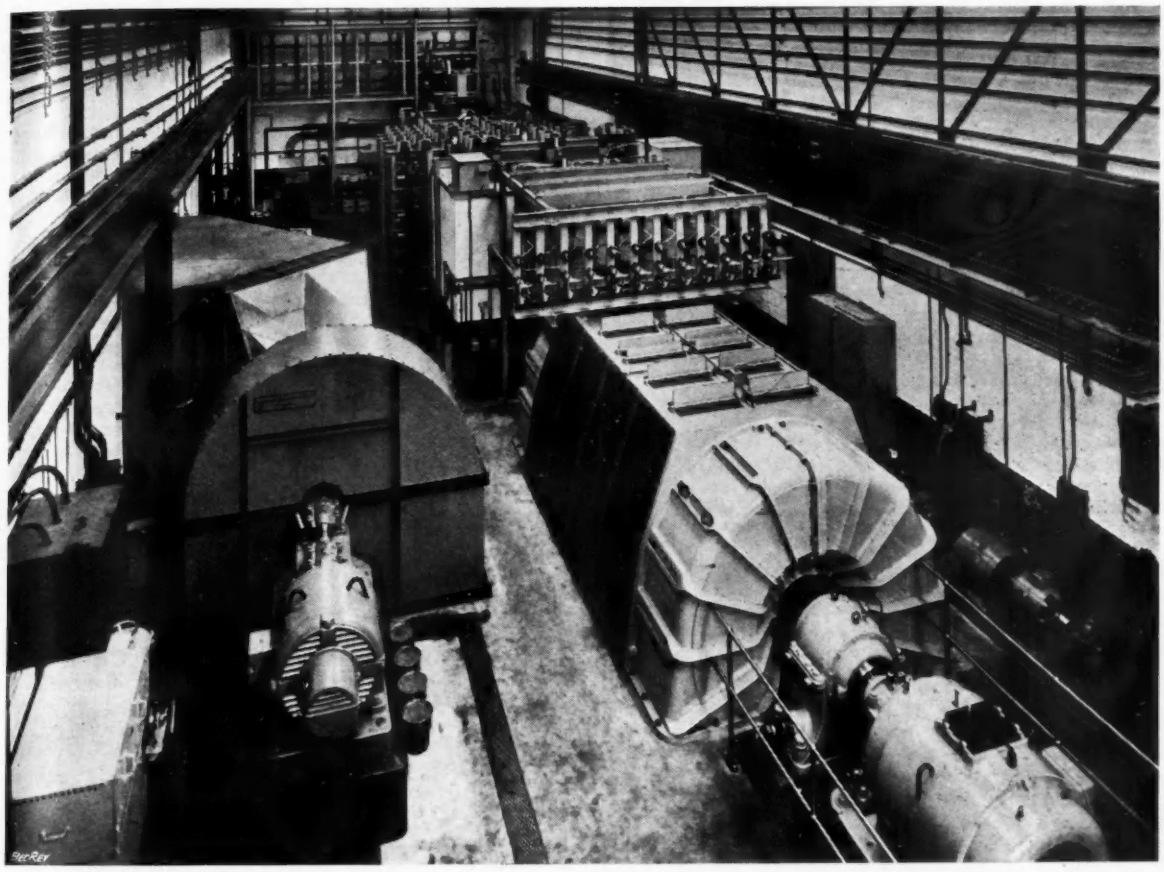
Left: Separate exciter driven by a 1,500-h.p. motor and coupled to an 11-ton flywheel. Right: The twelve-element magnetic oscillograph in the observation house

The observation house contains the control board for initiating and recording a test. Initiation is by means of an adjustable-speed, double-bob pendulum which in its travel makes a series of contacts to perform up to twelve functions; these include disconnection of the motors driving the alternator and exciter, excitation boosting, closure of the maker switch, tripping the test switch, and opening the exciting circuit of the alternator. A cathode-ray oscillograph is simultaneously operated by upper contacts.

A twelve-element electro-magnetic oscillograph (made at Witton) records all transients on one film. The use of gas-filled projector lamps relieves the attendant of making such adjustments as focusing and trimming. The twelve strips normally indicate current, volts and watts in each phase, operation of trip coil, exciting current and oil pressure. The travel of the switch contacts is traced mechanically by a kymograph in the test bay.

For recording the fluctuations of voltage at the instant of arc rupture, a cathode-ray oscillograph supplied by the Cambridge Instrument Co. has been installed. This instrument is made almost entirely of metal, is 8 ft. high, and weighs about 2¼ tons. Its photographic film is about 80 ft. long by 5 in. wide, and is fixed to a 3,000-r.p.m. drum, thus giving a film speed of close on four miles per min. The drum rotates in the vacuum of the oscillograph, which has to be recreated every time the film is changed; this is done by four mercury-vapour pumps backed up by a rotary box pump.

This design enables a record to be taken, the drum to be removed and reloaded and the vacuum to be re-established within twenty minutes. A clear record can be obtained at a writing speed of 100 miles per sec. Oscillograms are developed in a dark room between the observation room and the cathode-ray oscillograph room, with each of which it is connected by traps, so that the results are available within ten minutes of the application of a short-circuit.



General view of the interior of the generating station. The 50,000-kVA alternator is on the right and the air cooling fan on the left. Immediately behind the alternator is the concrete cubicle housing the master switch

Separate tests on circuit-breakers are made at ten, thirty, sixty and one hundred per cent. of the rated capacity, and frequently at considerably higher values. The test cycle is that given in B.S. Specification No. 116, the switch being required to break the short-circuit, then after a two-minute interval to make it and immediately break it by the operation of its own trip gear. The breaker must then be in a condition to be reclosed and to carry normal current.

While switchgear testing is the major activity of the new laboratory, facilities are available for proving other heavy-current apparatus.

Two I.E.E. Dinners

The annual dinner of the North Midland Centre of the Institution of Electrical Engineers was held on Friday last at the Hotel Metropole, Leeds. The diners numbered about 120 and Col. H. Cecil Fraser (chairman of the Centre) presided. Among others present were Ald. J. Pearson (Lord Mayor of Bradford), Mr. J. M. Kennedy (Pres. I.E.E.), Lt.-Col. E. Kitson Clark, Lt.-Col. T. Chadwick, Ald. J. W. Longley (chairman, Bradford Corporation Electricity Committee), Mr. F. Gilberthorpe (chairman, Sheffield Sub-Centre), and Mr. E. C. McKinnon (chairman North Western Centre). Mr. Kennedy, responding to the toast of "The President of the Institution," proposed by the chairman, referred to the recent serious accident at the Bradford power station. He said that what had been Bradford's misfortune might turn out ultimately to be to the benefit of the industry as a whole. It was necessary that they should all consider very closely what steps could be taken to prevent such happenings elsewhere. Dealing with the use of electric vehicles, he contended that the initiative should come from the electrical engineer. Looking into the conditions of ten cities and towns in that neighbourhood he found that the electricity supply in all cases was charged on the rateable value basis, but both the basic charges and the unit charges varied. These variations, he suggested, made it difficult for the owners of multiple concerns to make up their minds as to what they should do.

There was a convivial atmosphere at the 29th annual dinner of the London Students' Section of the Institution of Electrical Engineers, held at Pinoti's Restaurant on March 5th. Mr. E. L. Hefferman, the chairman, proposed the loyal toast. During the last year the Section has lost two secretaries, one going to Australia and one to China; Mr. C. H. W. Clarke now holds the position and he proposed the toast of "The Institution." The response was by Mr. E. W. Moss, I.E.E. Council representative, who gave a brief history of the Institution, and stressed the importance of maintaining its standing. The entertainments secretary, Mr. J. P. Harvey, proposed "Our Guests," a humorous response being made by Mr. G. Woods, Hon. Sec. London Graduates' Section, Inst.C.E. In proposing the toast of the "Students' Section," Mr. J. H. Rayner mentioned the enthusiasm of the provincial centres and said he hoped that the London Section would have larger attendances at its meetings. Mr. Hefferman replied.

Earthing and Testing. By H. R. Taunton, A.M.I.E.E.

Further comments on the I.E.E. Rules

IN the ninth edition of the I.E.E. Wiring Rules there was a note (127C) saying: "Investigations are being made with a view to specifying the conditions required for the satisfactory earthing of an installation, and it is proposed to include such a specification in a later edition of these Regulations." And here, in Section 10 of the tenth edition, we have it. No section has met with so much discussion and criticism. Much of it is misplaced, for many of the points criticised will be found by a comparison with the old Rules, 96 to 103, to have been in force since at least May, 1927. I have heard a prominent contractor, who prides himself on an exact observance of the rules, wax very sarcastic at the "new" requirement that lighting standards shall be earthed, quite ignoring the fact that the old Rule 103 had long ago insisted that "all portable metal fittings . . . shall be provided . . . with a terminal . . . for earthing," though, to be sure, nearly every maker of such fittings has also consistently ignored it.

It is easy enough to cite examples of the needlessness, or even danger, of general earthing, particularly in private houses, which form the vast bulk of the installations the Rules are designed to protect. I came across a case in point a week ago. A woman received a bad shock while cleaning the elements of a grill. She was standing on thick matting and had one hand resting on the cooker casing that was properly earthed, with the control switch "off." The explanation was that the neutral of the supply was also permanently (and correctly) earthed, while one side of the indicator lamp had carelessly been connected to the live phase terminal of the d.p. switch.

Another simple possibility is for a person cleaning a radiator (in a carpeted room) to get a shock through its earthed casing, because its single-pole switch is not "on the red." And in how many small houses, wired by speculative builders, can we rely on the observance of Rule 207?

The Real Trouble

Opponents of the principle can argue that with casings not earthed no shock would be possible, the victims being otherwise well insulated. The real trouble, in both examples, however, is due not to the earthing, but to some other careless or ignorant connection, and from carelessness and ignorance; from the freaks of the jerry wireman and the handyman, what rules can protect us?

It is too late in the day to reopen the old, tedious debate between the "earthers" and the "all-insulators." The opinion of the large majority has decided in favour of earthing, and, in the interests of uniformity, all must accept any code designed to enforce it. Nor can anybody reasonably complain if the code is stringent, since supporters and opponents alike must agree that partial or defective earthing is worse than none at all. The unfortunate thing is that the rules in Section 10 are so framed that they simply invite criticism. Rule 1001, in particular, is perhaps the worst drafted in the book. Einstein himself would have to study it carefully before he could be sure, first of its meaning, then of its intention, and last, of its reasonableness, or perhaps lack of it. Is it strange that the average contractor or wireman, failing to comprehend its six clauses, with their notes, cross-references and exemptions, finds it easier to damn it off-hand?

Futile Exemptions

The "exemptions," some of them needlessly repeated under different clauses, are mostly futile. What man in his senses would dream of earthing a saddle or a lamp cap, or the "metalwork on electric clock cases of non-conducting material"? Only a lawyer could have thought of providing for such absurd contingencies.

As it is worded many readers, not being lawyers, will be apt to jump to the conclusion that exemption III of Clause B contradicts the last sentence of Rule 403F, to which it refers. The operative syllable, however, is the little "un-" in "unexposed." Exemption II of the same clause, repeated in extension under C, certainly contradicted its reference in the original edition, but by a happy fluke the amendment to Rule 810B has restored it to coherence.

In Clause B the words "except where otherwise permitted under Regulation 403F," if they are not to qualify the whole clause—which they do not—should be read after the words "by connection."

In Clause C, and others, the increased stringency of the new rules may be seen in the words "all exposed metal" (without qualification), as compared with "all exposed metal liable to become alive" of the rule (96) which it replaces. It takes from the contractor the easy excuse that, in his judgment, it was unnecessary to earth certain metal. It will be noted, too, that to the "bathrooms, lift shafts," &c., of the old rule has now been added any position within 8 ft. of the floor.

The note to Clause E suggests a certain weakening of the principle. Why be content to "deprecate" the use of two-pin plugs. If the rule of earthing all portable apparatus is observed, there should be nothing but three-pin plugs in any normal installation. The "strong recommendation" that follows does not help matters, since it will not reach those most likely to ignore it, the actual users of apparatus.

Clauses A, C and D or Rule 1002 relating to bathrooms replace in a somewhat strengthened form the old Rule 100. It will be observed that here we rely, and rightly, rather on "all-insulation" than earthing.

In the Bathroom

Clause B is a new addition, and one that could have been spared. Its intention is good, but it is quite impracticable. However willing the contractor is to obey it, what house-owner, or architect, will suffer it? The bathroom of a modern house is often one of its show places. What would it look like when its marble veneers and gilded tiles were defaced with half-inch copper tape staggering from bath to hand-basin and towel-rail, with zigzags thence to sundry sockets and odd metal on the walls, Another suggestion that is impracticable to the point of fatuity is that the bathroom switch should be placed outside the door (Note to Clause D).

The A.S.E.E. editing this section for its members, practical men, has omitted the whole of Rule 1005, contenting itself with a short paraphrase elsewhere of its Clause D. That is really its only important clause, embodying the earth continuity test referred to in the later Rule 1109. It is, in a more stringent form, the old Rule 127B; and it should be particularly noted that the maximum value of the resistance under test must now not exceed 1 ohm, as against 2 ohms.

The rest of this rule is largely academic, *e.g.*, its Clause B, referring to the resistance of the "earth" (not the earth continuity conductor). It would be very interesting to know if any contractor has ever made the elaborate test in question, described in all its complications in Rule 1110; more particularly as an amendment gives an easy loophole for evading it. The whole rigmarole smacks of the professor and the laboratory, rather than of working conditions. The remaining rules in the Section, 1006 to 1008, are very much the same as those they replace, 101 and 102, in the ninth edition. Rule 1008 is rather suggestive of the once popular "treasure hunt." It gravely refers us to Rule 1316, to which we turn, palpitating, only to find a second reference, to Table 19!!

"Learn it By Heart!"

The note heading Section 11, an amplification of that to Rule 127 of the ninth edition, is very sound. Contractors ought to learn it by heart so that they may impress it on their customers, though some of them, perhaps, may not relish the bit about "satisfactory test-results" not in themselves ensuring "that the installation is satisfactory in all respects." This is an addition to the old note; a useful reminder that a good insulation test is only a negative proof of good work.

The new rules for testing should be read carefully, as there are many variations in them from the old one (127). In 1101, the maximum testing voltage is given as 500, the practical standard of modern meggers. In 1104, the required insulation resistance of a "complete" installation is now 50 megohms divided by the number of *outlets* instead of, as before, 25 divided by the number of *points*. The figure for a test between poles (Rule 1107) is the same. A new rule, 1102, gives the required insulation resistance for an "incomplete" installation (*i.e.*, for the wiring only). This is 100 megohms divided by the number of outlets.

"Outlet" does not appear among the definitions at the beginning of the book, but it is here explained as "points and switch positions." That is a little ambiguous. A point wired for three lamps is one outlet. A position wired for three switches controlling that point is also, presumably, only one outlet. If, however, the same three switches are wired each in a different part of a room, that would constitute three outlets. What is the limit between immediate proximity and definite distance at which one outlet becomes three?

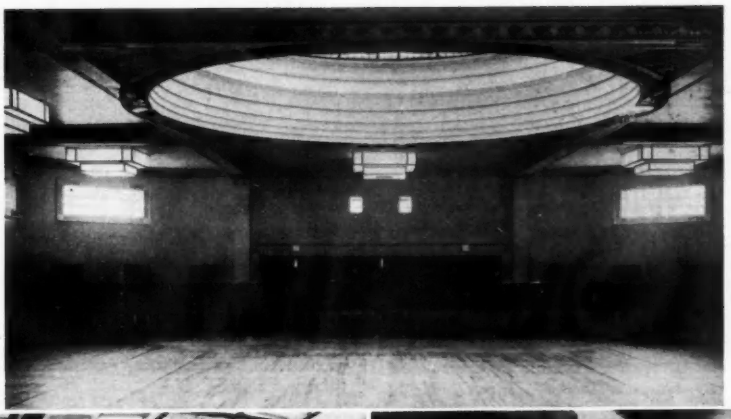
A new test now called for on the completion of every installation, in addition to the above insulation tests and the earth continuity test (Rule 1109), is one to ensure that all s.p. switches are on the live conductor. This is a valuable addition, as such a test, easily made if the (unfortunately) optional rule, 309, providing for distinctive colours for conductors, has been observed, is too often omitted. Its importance in these days of general earthing is obvious, as witness the cautionary examples at the beginning of this article.

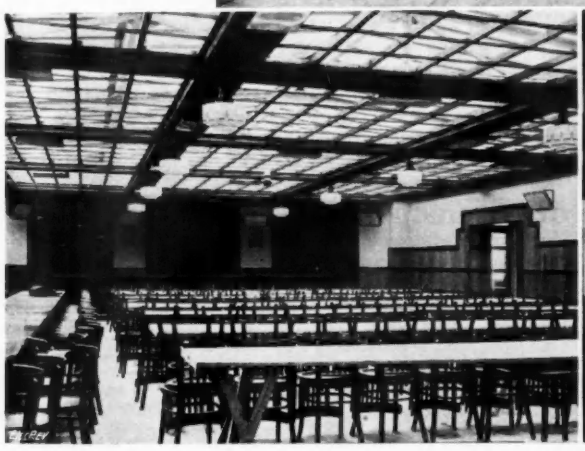
All-electric Air Conditioning

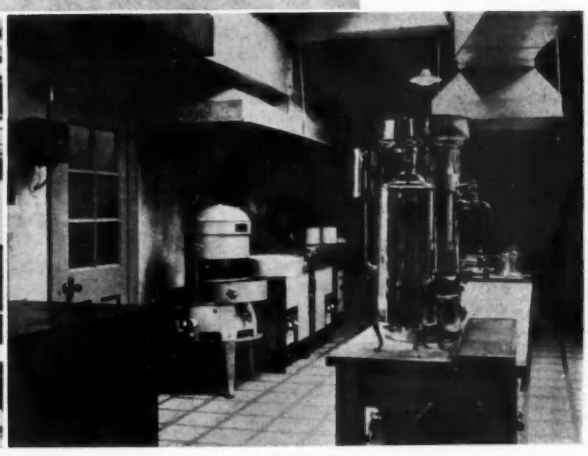
A plenum system at a seaside entertainment hall

THE success of the plenum system of heating and ventilation is proved by its ever-increasing adoption for large buildings, and we have hoped for many years that the electrical industry would win a larger and appropriate share of the work. Our greatest interest in the electrical equipment and services at the new Marine Hall at Fleetwood lies, therefore, in the plenum system which serves the main hall, for with its motor-driven fan and electric heating it is a truly all-electric job.

Under the stage at one end of the main hall, which has a seating capacity of 1,000, is a metal heating chamber, measuring about 7 ft. by 7 ft. by 4 ft., which is served at one end by an inlet trunk which opens out to the exterior atmosphere at about 30 ft. above ground level, while the other end is extended to a fan chamber which serves a system of distribution ducting under the floor. From this ducting air is fed to fourteen wall rises which consist of brickwork chases rendered on the inside with a smooth cement and sealed at the front by sheet metal behind the general wall panelling. An outlet grille (about 2 ft. by 3 ft.) at the top of each chase and about 6 ft. from the floor level blends with the architectural features of the hall. At the skirting level outlet grilles open out into the basement, and by means of a secondary inlet on the trunk and damper control the air discharged into the hall can be recirculated through the heaters. At four points in the roof of the hall and around the periphery of the dome are outlet points with fans of such a capacity as nearly to balance the inlet fan and thereby establish the plenum. Because of the somewhat exceptional local atmospheric conditions, the extraction plant can be used independently of the plenum system.







Top: The auditorium from the stage showing dome and ceiling lighting. Left: Flood heaters in the café showing ceiling suspended "Comfortstat" and plenum grilles in the rear. Right: Some of the kitchen equipment, including the "Rotopan" (left) and café set (front)

The plant is designed to maintain a temperature of 65 deg. F. with an outside temperature of 32 deg. F. and to handle 14,000 cu. ft. of air per minute. The elements are constructed of ribbon resistor wound on mica strip, the assembly being bolted vertically to insulators on vertical iron brackets fixed at the top and bottom of the chamber. Ten such elements are arranged in each of the six sections in the chamber, and each section is wired separately in star, so that, no matter how many sections are on circuit at one time, the load is balanced on the three-phase supply. The sections are controlled separately by thermostats which directly operate contactor gear. The six thermostats, which are located together on the wall in the main hall about 6 ft. from the floor level near the entrance, are set for different operating temperatures, so that the first section of the heater is switched on at 58 deg. F. and the last section at 64 deg. F. The total loading of the plenum system is 182 kW.

In the heating chamber at the inlet and outlet sides of the elements are two immersion-type thermostats set at 200 deg. F., and these are wired in series with the thermostats in the main hall. Thus, should the heating chamber become too hot the control circuit would be broken by the operation of the chamber thermostats. A specially made centrifugal-type inlet fan is driven by a 4-h.p. "Super Silent" Bull motor of the slip-ring induction type, with motor and starter control for 30 per cent. overall speed regulation to a maximum of 900 r.p.m. The contactor and thermostat circuits are fed from the motor side of the starter circuit, so that the heaters cannot be switched on until the motor is running. Furthermore, should the motor trip, the heaters would be automatically switched off. The complete plenum installation was supplied by Messrs. James Keith & Blackman Co., Ltd., the heaters by Messrs. George Nobbs, Ltd., and the contactor control gear by the Electrical Apparatus Co., Ltd.

In addition to the plenum system heating, there is around the auditorium walls a continuous line of skirting panelling supplied by Space Heating, Ltd., and loaded at 80 W per ft. run. The idea of this additional 8 kW of heating is to provide warmth for conditioning the building when the plenum system is not in operation. To the back of the front metal cover of these box skirting heaters are clamped D-shaped resistor-threaded porcelains, which, when the whole is assembled, are backed with a layer of glass silk insulation. These heaters are controlled in four sections by thermostats suitably located around the room.

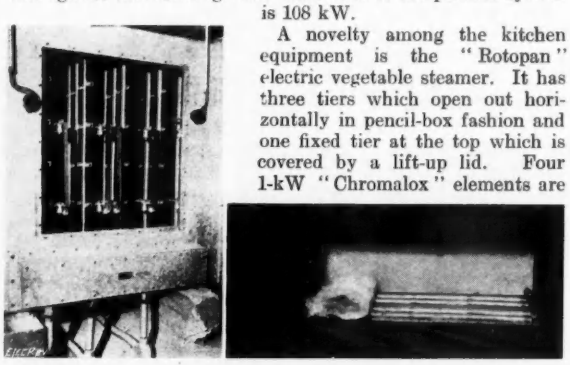
The fact that the roofs of the tea house and annexe on either side of the main hall are virtually all glass has led to the adoption there of practically all radiant heating by means of 1,250-W Unity flood heaters fixed to the wall about 8 ft. from the floor level or suspended from the roof framework horizontally for downward projection. In each of these two rooms the whole of the radiant heaters are controlled by a "Comfortstat" centrally suspended from the ceiling. The setting of this controller is such as to result generally in an air temperature of about 60 deg. F., but because the operation of the "Comfortstat" is dependent on both radiation and air speed the actual temperature of the "controlled" room is variable, although the "degree of comfort" is maintained constant.

Under the conditions so far described there would be two basically opposed systems of heating which would serve the same people when passing to and from the main hall and the tea room.

Experience has suggested that lady visitors in evening

dresses are particularly sensitive to such a change of conditions, and so an effort to establish a "balance of heating" between the two rooms (main hall and tea room or annexe) led to an extension of the plenum system to the smaller chambers.

In the entrance hall there are six flood heaters with thermostatic control, tubular heaters in the dressing-rooms and cloak-rooms being similarly governed. The stage, which measures about 45 ft. by 30 ft., is equipped with 4.5 kW of skirting panels. The total loading of the heating equipment throughout the building other than that of the plenum system is 108 kW.



Duplicated elements in plenum heating chamber, and (right) interior of skirting panel

A novelty among the kitchen equipment is the "Rotopan" electric vegetable steamer. It has three tiers which open out horizontally in pencil-box fashion and one fixed tier at the top which is covered by a lift-up lid. Four 1-kW "Chromalox" elements are clamped to the bottom of the water chamber and are three-heat controlled. A constant supply of boiling water is normally provided by a 7.2-kW Stott café set which is complete with milk and coffee urns. In rush times this boiling water supply is supplemented by supplies from "Burco" wash boilers.

Other kitchen equipment includes a 9-kW 2-pan fish fryer, supplied by Messrs. S. Parker & Co., Ltd., a "Magnet" double-oven cooker and roasting oven, a Parker hot-cupboard and bain marie with two carving points, and a 30-gal. "High-low" storage water heater for washing-up water. An unusual scheme is presented by the Asco separate cold-storage room and a refrigerator cabinet in the kitchen which are both served by the same compressor equipment. A Keith Blackman air extraction system with which the kitchen is equipped is designed to afford 60 changes of air per hour. The dressing-rooms and cloak-rooms are equipped with 5-gal. storage water heaters.

The lighting of the Marine Hall is also of unusual interest. Into the main hall ceiling are built eight two-tier metal frame and opal glass panel lighting fittings equipped, all told, with 54 white, 55 red, 55 green, and 108 blue 150-W lamps. These lamps are all located above the ceiling level and the excellent lighting results are directly attributable to the fact that each lamp is in a prismatic reflector. Around the edge of the dome are sixteen 5-ft. lengths of auditorium troughing equipped with 25 white, 26 red, 26 green and 51 blue lamps of 150 W each.

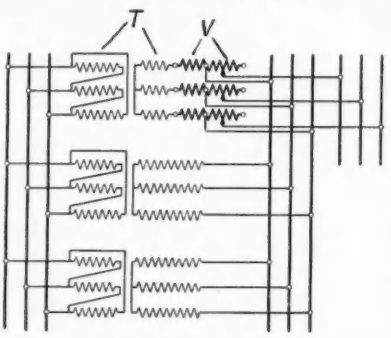
In the auditorium wall on each side of the stage is a chamber with two 2,000-W "front of house" projectors. Each projector is provided with four electrically operated colour screens which are controlled from the stage switchboard. Acting area lighting is provided by an overhead batten at the front of the stage, a smaller batten serving the cyclorama at the back of the stage. There are also four 6-ft. portable groundrows and two wing flood lightings trolley units which are supplied *via* sockets under traps in the stage floor. All the white lighting is controlled directly from the stage switchboard through hand dimmers, while all the coloured lighting is controlled from the switchboard through remotely situated motor-driven dimmers. This control scheme relates to the lighting in both the auditorium and the stage. Colour selection is carried out at the switchboard by selector dials which operate the motor dimmers *via* 25-V contactors.

The whole of the lighting equipment for the stage and the main hall, totalling 90 kW, was supplied by Holophane, Ltd. In the café and annexe excellent effect lighting is given by totally enclosed G.E.C. artistic units. In the cloak-rooms 8-in. cubes give pleasing results, while in the kitchen the opal and metal dual-reflector "Benflux" fittings afford essentially utility lighting. Synchronous clocks about the buildings were supplied by Messrs. Green and Son.

The whole of the electrical equipment was supplied to the specification of Mr. W. P. Lilwall, the borough electrical engineer.

Voltage Control of Transformers

THE advantages of regulating the voltage of a bank of transformers by tap-changing on one unit are discussed by W. Thiessen in *Elektrotechnische Zeitschrift* (Vol. 37, page 113). The arrangement is shown by the accompanying illustration, the regulating transformer T having tap-coils V capable of carrying the total output. This method of voltage control is specially economical when the total capacity is increased by the addition of a regulating power transformer capable of controlling the voltage of the bank output. If, as is generally the case, the older transformers have plates of relatively high-loss material, the new unit can be used advantageously for base-load service, its power windings being designed for the base load, and the regulating winding for the total output. Experience with tap-changing switches justifies their application to the single-unit method of control.



The first regulating power transformer used in this way was installed at the 6/60-kV Kiel-Wik sub-station of the Vereinigten Grosskraftwerke Schleswig-Holstein, Rendsburg, about eighteen months ago. This sub-station is the main feed point of the 60-kV network and serves for the exchange of load between interconnected supplies. In order to meet the service requirements it was found necessary to increase the transformer capacity and regulate the voltage. The original equipment consisted of three transformers of 1,500, 3,000 and 6,000 kVA, respectively. A 10,000-kVA unit was substituted for the 1,500-kVA transformer and used to regulate the voltage of the entire output. Ordinarily, the 3,000- and 6,000-kVA transformers are connected to the normal tapping of the regulating transformer, but they can be connected to the bus-bars in emergency, their voltage then being not regulated. This arrangement necessitated only minor alterations to the sub-station building and switchgear. Outwardly, the regulating power transformer is characterised only by six instead of three high-voltage lead-outs, three being connected to the non-regulated transformers and three to the 60-kV (regulated) bus-bars.

At normal voltage, and with the regulator in its neutral position, the iron loss of the new transformer is 12.9 kW, while the copper loss is 43 kW when regulating its own output and 48 kW when regulating the total output. Compared with the former operation with non-regulated transformers the new transformer effects a saving of about 250,000 kWh per annum on an output of 50-million kVAh. The saving on the capital cost of the extension, compared with the installation of a special regulating auto-transformer, was about 30 per cent. The plant has given complete satisfaction in service, and has realised the anticipated savings.

As an example of the saving effected by the substitution of a low-loss regulating transformer for one of a group of old non-regulated transformers, without increase in the total capacity, the author gives the following data:—The original installation consisted of a 2,000-kVA, 60/15.7-kV transformer with 12.9 kW iron loss and 18.4 kW copper loss; and a 4,000-kVA, 60/15.7-kV transformer with 15.7 kW iron loss and 32 kW copper loss. The new plant comprises a 2,000-kVA regulating transformer, with 5 kW iron and 10 kW copper loss, substituted for the original 2,000-kVA unit, and provided with a regulating winding for 6,000 kVA total output.

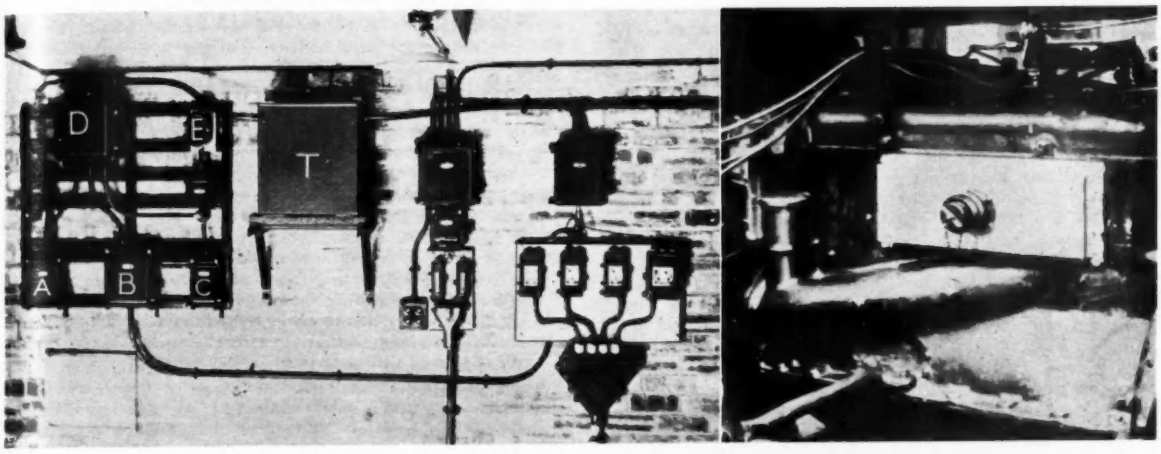
Regarding the saving effected for an annual output of 10-million kVAh and a maximum load of 3,000 kVA, the original installation supplied 8-million kVAh from the 4,000-kVA transformer, in service 4,000 hours per annum, with a maximum load of 3,000 kVA; and 2-million kVAh from the 2,000-kVA transformer, in service 3,760 hours per annum, with a maximum load of 1,500 kVA. The annual loss was 178,000 kWh. On the other hand, the new 2,000-kVA transformer, with 10 per cent. voltage regulation, delivers about 2,400 kVA and supplies 9.5-million kVAh per annum. The 4,000-kVA unit is left only the peak supply of 0.5-million kVAh spread over about 1,000 hours per annum. The total loss is thus reduced to 90,500 kWh per annum, or by about half.

Warming Vehicle Radiators.

By D. G. Sandeman, B.Sc., A.M.I.E.E.

A method of applying electric heat directly to the outer surface of the water jacket

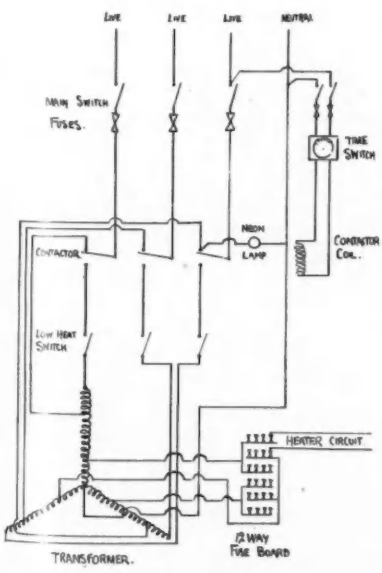
THE starting of large petrol engines in cold weather is troublesome, and results in undue wear and tear in the cylinders. So important does this problem of starting become that some fire stations are equipped with a special hot water system for the engine radiators. A more convenient method is to apply the heat directly to the outer surface of the water jacket. An installation carried out at Powderhall, Edinburgh, is for twelve public cleansing vehicles in a new garage without any other system of heating. The space which would have been used for the boiler and fuel store has been made available for the garage floor. In view of this, special precautions had to be taken to guard against freezing.



Left: The switchgear, showing (A) the night heat switch, (B) the main switch, (C) the clock switch, (D) the contactor, (E) the time switch, and (T) the transformer. Right: An electric heater fitted to a vehicle engine

By means of a special transformer the three-phase, 400-V supply is reduced to 115 V for the period of maximum heating and still further reduced for all-night heating. A transformer has two advantages for this duty, for the reduction in voltage is effected for safety and also to simplify control.

It is well to remind readers of the danger of using a.c. for heaters of this kind. Garage floors are usually wet and tyres are excellent insulators. Thus every part of the metal bodywork is a potential source of danger if made alive by the leakage currents often experienced with this type of heater. The line voltage reduction to 115 (66 V above earth) in conjunction with a suitable three-pin plug connection makes doubly sure that accidents will be avoided.



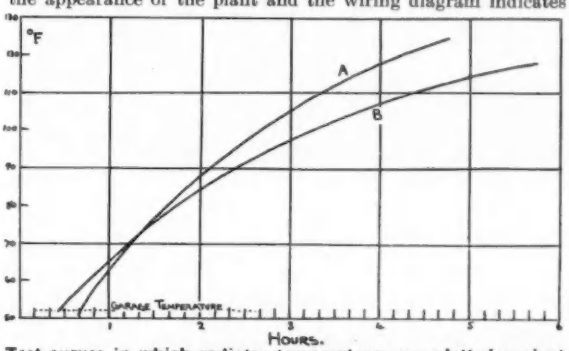
Wiring diagram

Test curves in which radiator temperatures are plotted against time show (A) results obtained when the radiator was covered by a muff, and (B) the same data for the radiator uncovered. In each case 900 W loading was employed, engine and radiator capacity in each case being approximately ten gallons. From these curves it may be deduced that 200 W all night will produce a temperature rise of 20 deg. F. and 900 W for one hour will give approximately 30 deg. F., which will be sufficient to free the oil and facilitate starting. Anyone wishing to check these figures can apply the method given in the ELECTRICAL REVIEW of December 28th, 1934, p. 896, in the article on "Temperature Curves."

The cost of running (0.95d. per day per machine for the morning heat and 3.2d. for sixteen hours at 200 W) cannot be said to be excessive, bearing in mind that the first is only required during the winter months and the second merely for a few weeks in the year. The total annual electricity bill should not exceed £15 for the twelve machines.

Should less than 200 W be sufficient, alternative tappings at 150 and 100 W are provided. If more than 30 deg. F. is required in the morning, the time-switch can be set to one and one-half hours, giving 40 deg. F. rise.

Safety and reliability have been studied in the design of the installation. The photographs convey a general idea of the appearance of the plant and the wiring diagram indicates that voltage control is effected from the supply side of the transformer. Although this necessitates a larger transformer, it introduces an economy in contactors and wall space. The time switch, being of the synchronous movement type, requires no winding or regulation.



Test curves in which radiator temperatures are plotted against time

I believe that this is the first installation of the kind in the country, and look forward to its more general adoption. I am indebted to Mr. N. Graham Wilson, B.Sc., inspector of lighting and cleansing at Edinburgh, for permission to publish this article.

Commencing an Electrical Career

We have received from Geoffrey Rivington Publications, Ltd., No. 3 of a series entitled "Your Start in Life," which deals with electrical engineering (price 6d.). In a foreword to this useful little publication, Lord Hirst briefly describes its scope in commending it to the attention of parents and guardians who are considering the possibilities of an electrical career for their boys. A general standard is set of a university or technical college course of at least three years followed by workshop experience of at least two years. Particulars are given of the curricula and facilities provided by University, King's, City and Guilds, and Faraday House Colleges, and by Glasgow, Manchester, Birmingham and Durham Universities, together with information regarding fees payable and examinations. Chapters are devoted to the training schemes developed by the British Thomson-Houston Co., the English Electric Co., and the Metropolitan Vickers Electrical Co. For radio and television engineering, the reader is referred to another booklet in the series.

The Future of the Cooker. By J. S. Foreman

The sales aspect of automatic control

FROM an engineering point of view, the modern electric cooker is a high-grade product, reliable, robust, largely fool-proof and capable of turning out well-cooked food. Why then, it may be said, gild the lily, so to speak, by adding the complication of automatic control at more cost, when our expert demonstrators tell us that it gives them no better cooking results. Let us consider the thermostat-controlled oven problem, not as engineers or expert cooks but as common salesmen with the task of selling to the average women.

In this country there are approximately 12 million homes, of which, roughly speaking, 6 million now use some electricity. About one in ten of these 6 million wired homes has an electric cooker. Over 6 million homes use gas for cooking and of the non-gas cooker users a substantial number are so situated that they have neither gas nor electricity available.

We can safely assume that gas cookers, therefore, are installed in nearly two out of every three houses where gas is available. These figures, in effect, go to show that of the 5½ million dwellers in wired homes who are not now using electric cookers almost all are cooking by gas. This market obviously is mostly the "ordinary working-class home" where the housewife very often considers cooking only as an irksome duty which cannot be escaped and demands a method involving a minimum of attention, time, labour and skill.

To successfully compete in this vast market now largely using our competitors' product, we must be able to offer something at least as good and able to do all that their present cooker does. With our non-thermostatic electric cooker, we have to teach the housewife a new technique—the time-temperature method—which she may or may not assimilate at first and which in any case is different from her accustomed habit.

Our salesman's job would be made definitely easier if he could positively assure the housewife that the oven control is identical with that to which she has been accustomed. Oven cooking by "setting a pointer" has to be acknowledged as an entirely satisfactory method, and we are not advocating something new but a method used and proved by the very people we hope to secure as new users. This is not so small a matter as some folks would have us believe.

Briefly, the chief advantages of automatic control appear to be:—

(1) Accurate pre-heating—a godsend to the ordinary housewife who can confidently go about her other duties in a way impossible at present; this feature also largely counterbalances the longer pre-heating period necessary with most electric cookers.

(2) The simplification of cooking—calls for the minimum of labour and skill.

(3) Improved results—this is specially noticeable where pressure is low or variable.

(4) Choice of any temperature (between limits)—useful at all times and valuable to the fastidious cook.

(5) Improved economy—this off-sets any increased cost to the user.

The above points are those of importance to the user, while the following concern the supply authority:—

(6) A needed reply to the "Regulo"—particularly essential in competitive areas.

(7) Every prospect of reduced service costs, both of maintenance staff and demonstrators, which, if realised, will far more than outweigh any small extra capital cost.

It is sometimes argued that those using non-automatic electric cookers would immediately want them changed. If serious weight be given to this and similar points, progress will be impossible and further, the gas authorities successfully solved this identical problem.

Recently the subject was discussed with a number of representative manufacturers at the British Industries Fair, all of whom appeared to be against the introduction of thermostats, claiming that their cookers did not require them and that tests made by their trained demonstrators showed equally good results without thermostats. Some of the manufacturers' representatives stated that their wives—who, they said, knew a good deal about electric cooking—had found the same thing. Nearly every manufacturer stated that no real demand for thermostatic cookers had been experienced. One manufacturer's representative argued that for certain cooking a falling temperature was necessary which could not be achieved automatically by a thermostat.

It is not claimed that a thermostat is necessary or even that it will give better results in the hands of an expert cook or one who can devote her whole time to cooking, and this probably accounts for the reports received by both manufacturers and supply authorities from their own demonstrators and from wives of some of their interested staff.

Our big potential market, I think, has not yet been sufficiently investigated to ascertain the real requirements and idiosyncrasies, if any, of the typical household and the hard-worked woman responsible for its smooth running on a strictly limited purse, to whom we must look for the largest part of our new business, not only to-day but for many to-morrows.

It is not contended that electric cookers, even when fitted with thermostats, will be the last word. Three-heat or even four-heat boiling plates, although able to meet the requirements of capable cooks are still open to improvement which will come in time, and though we can be proud of our present day electric cookers—with which we are satisfactorily securing a large business from our chief competitors—we shall undoubtedly have something better to offer year after year.

We shall certainly need this better cooker. Our competitors are very much alive and will certainly endeavour to improve their product, although their job may be harder even than ours.

New Designs in French Domestic Apparatus

THERE was a good section given over to electrical appliances at this year's Salon des Arts Ménegers held in Paris. A number of these were, of course, imported, but several were French products, and it was interesting to notice that the French manufacturer is doing his best to make up for lost time in this field. Most of the French designs shown were somewhat smaller than their American counterparts, questions of consumption having been carefully looked into and every attempt made to keep this as low as is compatible with good results.

A Bernard Huet heat-storage cooker

A heat-storage cooker with four hot-plates was one of the outstanding exhibits. The oven has an element at the top for grilling, but when used for baking or roasting it operates on the heat storage principle. This gives an even temperature and permits the preparation of any sort of roast or baked dish without danger of burning. At the same time, advantage can be taken of cheap night tariffs. The controls of the hot-plates and heat storage are combined on two switches. One controls all the elements except one, which is arranged with a separate control adjustable for three temperatures. The loadings are 400, 1,200 or 1,800 W on the directly controlled plates, and 400 W on heat storage. The heat-storage is controlled by a thermostat built into the storage plates. A water heater with a capacity of about 2 gal. is embodied in the cooker.

Particular attention has been paid to lagging to avoid any waste of heat, and covers are provided for the hot-plates to conserve the heat when they are not in use.

Another novelty is the Perlia grill, two models of which were shown. One is in the form of a small table with a heated top, while the other resembles a small oven without a front, the elements being placed so that grilling can be done below in the direct heat of the elements. The smaller model is entirely chromium plated with an 800-W element under the corrugated top that is used for grilling or toasting. It takes up very little room. The larger model is about a foot square and ten inches high, the outside being entirely enamelled, the sides in white or ivory and the top in black.

The new Als-Thom Uni-Duplex cooker is a neat model. It has four hot-plates and a combined oven and grill, the arrangement of these parts being such as to make them readily accessible.

Vacuum cleaners and refrigerators showed little change. S.E.V., however, have introduced a new cleaner in which a two-way switch permits the speed of the motor to be regulated and thus allows the degree of suction to be reduced for the cleaning of fragile objects.

Selenium Cells for Photometry

I.E.E. papers on their construction and operation

TWO papers were presented at the March 6th meeting of the Meter and Instrument Section of the Institution of Electrical Engineers in London. The first, by Prof. J. T. MacGregor-Morris and Mr. R. M. Billington, is devoted to a detailed study of the characteristics of the selenium-iron photo-rectifier cell and its response to intermittent illumination.

The original Lange cell consisted of a copper anode coated with a cuprous oxide, which forms the light-sensitive cathode. Under the influence of an electric field electrons pass more readily from the copper to the oxide. When exposed to light radiations electrons tend to pass in the reverse direction from the oxide to the copper. Thus when used as a rectifier the oxide is positive and the copper is negative. This direction of current flow holds for all rectifier photo-electric cells.

The iron type of cell consists essentially of a thin film of grey metallic crystalline selenium deposited evenly over the surface of an iron disc. Two electrodes (copper rings) are pressed in contact with the light-sensitive selenium film and the iron disc. The whole is mounted in a bakelite case fitted with a glass window, which is evacuated and sealed to preserve the film from the atmosphere. Two types are available, one having a much higher internal resistance than the other.

Current Unaffected by Temperature

In an endeavour to overcome the effect of the external resistance and temperature the possibilities of the Campbell-Freeth compensation circuit were investigated by the authors, but their results indicate that the generated current is strictly proportional to the illumination and that it is unaffected by temperature. Further the effect of applying an external voltage for different values of the illumination showed that the advantages of the slightly increased sensitivity gained are greatly outweighed by the disadvantages of having auxiliary apparatus.

The conclusions are that the current is an essentially more fundamental property of the photo-rectifier cell than the e.m.f. and that the total generated current (external, and internal leakage) is strictly proportional to the illumination. The current in the external circuit is only proportional to the illumination so long as the external resistance is small compared with the internal resistance, but this dependency for linear response on the value of the external resistance can be compensated for. The current output is of the order of 1 to 3 μA per ft.-candle and the generated current is unaffected by temperature.

The internal resistance of the cell is the only property affected by temperature and the reduced sensitivity with increased temperature is due to change of internal resistance and not to reduced generated current. The response to intermittent illumination is poor, owing to the fact that the output is reduced with increase in frequency, suggesting a "by-pass" action. But from the work so far done it would appear to respond instantaneously to changes in illumination.

Ease of Application

Therefore the photo-rectifier cell in its present state of development is inapplicable to sound recording and television, owing to the reduction of output with increase of frequency and distorted wave-form, but it is suitable for photometric measurements. The photo-rectifier cell is being applied extensively to photometry on account of the ease and simplicity with which measurements can be made, and it is possible to obtain a fair degree of accuracy provided certain precautions are taken, namely, that the resistance of the measuring circuit used is kept low and remains constant and the necessary temperature correction is applied.

As evidence of the stability of this type of photo-rectifier cell, the same cell has been periodically heated and cooled and subjected to very high intensities of illumination over a period of six months, and the greatest variation in sensitivity recorded has been 5 per cent., but the cell has recovered after remaining in the dark for twenty-four hours. The great advantage of the photo-rectifier cell is the absence of any auxiliary apparatus such as a battery, but on the other hand for more precise work the advantages gained by using the Campbell-Freeth compensation circuit greatly outweigh the disadvantages of the auxiliary apparatus required.

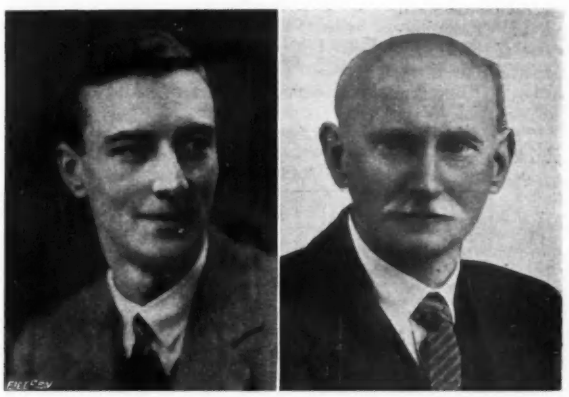
The compensation circuit consists of a microammeter connected in series with a photo-rectifier cell and a potential divider. A galvanometer is connected across the photo-rectifier cell terminals. The applied potential is adjusted until there is no deflection of the galvanometer, and therefore no difference of potential across the photo-rectifier cell terminals. The sensitivity of the adjustment is solely dependent upon the value of the internal resistance. The latter is a function of the intensity of illumination and has been shown to decrease with increase in illumination; consequently the sensitivity of measurements made in this manner decreases correspondingly as the illumination is increased.

The authors' experiments were made with assistance from the research funds of Queen Mary College, University of London.

Accuracy and Colour Correction

The manufacture and properties of the selenium rectifier photo-cell, as developed at the National Physical Laboratory for use in photometry, are described in some detail in the second paper, by Mr. J. S. Preston. The conclusions reached by the author from his survey of the subject are that the uniformity of the characteristics of different cells of a given type still leaves a good deal to be desired, a small percentage of cells proving unsatisfactory for photometric purposes owing to large drift, high temperature coefficient, unstable output, change of sensitivity with age, and so on. The last two defects have not been dealt with in the present paper, since a prolonged examination of a large number of cells would be desirable before any representative opinion could be expressed. It is, however, frequently found that these defects are associated with the others just enumerated.

Selection from a batch is thus desirable in the case of cells intended for accurate photometry. The degree of accuracy required will generally determine the strictness of the selection as regards such characteristics as drift and linearity of response. Where colour characteristics and response to oblique illumination are concerned, the qualities required will depend on conditions of use. Other properties, such as temperature coefficient, will probably be of the same importance for whatever purpose the cell is to be used.



[Lafayette

Two of the authors of last Friday's I.E.E. papers. Left: Mr. J. S. Preston, M.A., who is general secretary of the International Commission on Illumination. Right: Prof. J. T. McGregor-Morris, of the Queen Mary College, London.

The variations in sensitivity over the surface of a cell often render it unsuitable for the measurement of flux in a beam of light which falls within the sensitive area, and the position and cross-section of which are not fixed.

Cells can be found which satisfactorily comply with all the requirements of precision photometry if one omits for the moment the question of colour correction. The cell of average quality will, however, generally be just far enough from this ideal to render necessary precautions of various kinds if quite appreciable error is to be avoided. The cells are thus suitable in the main for measurements of a commercial type when the accuracy aimed at is not so high as the best obtainable visually.

The introduction of the selenium rectifier cell into portable illumination photometers has rendered available an instrument of considerable practical utility which is at the same time simple in operation. In expert hands such an instrument may yield results of scientific precision. On the other hand, in view of the possible sources of error above described, a misunderstanding of its possible limitations may lead to almost valueless results. The ideal use for such an instrument is the comparison of two illuminations not differing markedly in colour or spectral distribution of energy.

The subject of colour correction is of a different nature from the other problems associated with the employment of photocells in photometry. Ideally, it is simple, and consists in the modification of the spectral sensitivity curve of the cell to make it identical with the standard luminosity factor. Practically, colour correction varies between this ideal and the design of a simple colour filter for the intercomparison of a few well-defined types of light source.

Electricity Supply Costs.

By F. J. Elliott, A.M.I.E.E.

THE electricity supply industry is continually being urged to adopt a uniform method of charge as a step towards the eventual unification of tariffs; the latter implies the necessity for some measure of uniformity in costs. When investigating the question from a national viewpoint, in order to arrive at a basis for choosing a representative number of undertakings from the 650 dealt with in the annual returns of the Electricity Commissioners, I decided to extract the relevant figures of all those selling ten million kWh per annum or more. About 150 undertakings fall within this category. They serve populations varying between 3,700 and one million, and sell from ten million to five hundred million kWh per annum.

Although these representative undertakings form only twenty-three per cent. of all authorised undertakings, they supply sixty-four per cent. of the total number of consumers, and seventy-eight per cent. of the kWh sold. Examination of the figures relating to them should, therefore, give a reasonably accurate idea of the costs of electricity supply.

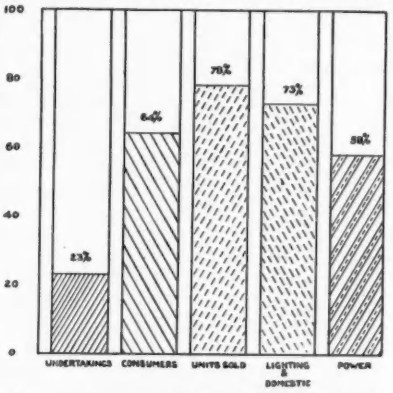


Fig. 1.—Representative undertakings in relation to total number

The minor effect of load factor on distribution economics

The highest and lowest figures for each item are given in table I.

TABLE I.

	Highest: Pence per kWh.	Lowest: Pence per kWh.
Total working costs	2.00	0.2
Cost of energy	0.66	0.1
Distribution	0.35	0.01
Management	0.39	0.01
Rent, rates and taxes	0.58	0.02
Interest and redemption ...	1.21	0.06

As a few undertakings with small outputs could extend these figures over a very large range, I ascertained the percentage of the total output of all the representative undertakings showing costs within defined limits (tables II and III).

Fifty-three per cent. of the total output of the representative undertakings show costs within a range of from 0.2 to 0.29d. per kWh, but the addition of the remaining working charges gives a very much wider variation in the figures; the predominating range of cost is between 0.4d. and 0.6d. per kWh, fifty-one per cent. of the total energy being taxed with costs between these values. The wide diversity in the total working costs is created by variations found in each of the costs and is not attributable to variations under any particular heading.

The analysis has shown so far that, while there is some degree of uniformity in the cost of energy, the remaining costs extend over a very wide range. The operations of the Central Electricity Board will result in a standardisation of the energy cost within reasonably small limits, but it must be borne in mind that 63 per cent. of the total capital expenditure and 60 per cent. of the annual working costs of authorised undertakings are on account of transmission, distribution and management. Expenditure under these headings, therefore, calls for similar expert attention to that received by generation.

The prevalent idea is that load factor controls all costs. In order to ascertain whether this theory is borne out in practice, the load factor of each of the undertakings was plotted against the cost per kWh, but it was found that the influence of load factor was not very obvious, for the reasons given below.

The distribution cost per kWh sold decreases with an increase in the number sold, irrespective of any variation in load factor. Management is made up of salaries of engineers, accountants and clerical staffs and collectors, stationery and printing, and general establishment charges. The cost per kWh on account of these items is governed entirely by consumption per consumer, irrespective of the load factor of the individual supplies and the resultant system load factor.

The largest item included under the heading of rent, rates and taxes is, generally speaking, on account of rates, and these are based on the profits of the undertaking, which need not bear any relation to load factor. Interest and redemption charges show a wider variation than any, reflecting the policy of the management of the undertaking in the past rather than giving an indication of the capital value of its plant to-day and the consequential fair tax per kWh on account of these charges.

TABLE II.

Cost of energy, in pence per kWh.	Percentage of total kWh output of all representative undertakings.
0.6 to 0.7	4
0.5 to 0.65	7
0.4 to 0.5	9
0.29 to 0.4	22
0.2 to 0.29	53
0.1 to 0.2	5
	100

In addition, capital expenditure on distribution does not follow maximum demand so closely as in the case of generation, as the plant capacity of a station is laid down to meet the demand for a few years, whereas a distribution system is designed in all essential features to satisfy anticipated requirements for a very much longer period.

Figures relating to all undertakings with a load factor over thirty-five per cent. show that low costs do not necessarily follow high load factors.

TABLE III.

Total working costs, in pence per kWh.	Percentage of total kWh output of all representative undertakings.
1.0 to 1.9	6.4
0.9 to 1.0	3.0
0.8 to 0.9	3.0
0.8 to 0.7	6.0
0.7 to 0.6	12.6
0.6 to 0.5	19.0 } 51
0.5 to 0.4	32.0 }
0.4 to 0.5	13.6
0.2 to 0.4	4.4

Eighteen per cent. of the representative undertakings have load factors above 35 per cent., ranging from 35.2 to 47 per cent., with total working costs of from 0.3 to 1.12d., energy cost of from 0.19 to 0.75d., and outputs of from 10.6 to 509.5 million kWh. The number of consumers varies from 32,000 to 119,000.

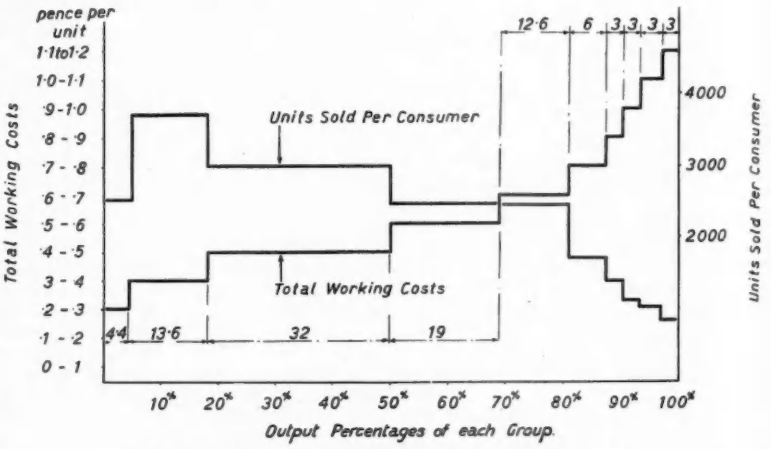


Fig. 2.—Working costs of representative undertakings

High load factors are obtained by small and large undertakings, irrespective of the proportion of the total output sold for any particular purpose.

While load factor undoubtedly has a preponderating effect on generation costs, its influence on distribution lessens with an increase in the number of points at which a supply is given,

Meetings and Discussions

Metallurgical Papers

Metallurgical Progress

AMONG a number of papers presented at the annual meeting of the Institute of Metals in London on March 11th was one in which Mr. C. Blazey (Metal Manufacturers Pty., Ltd., N.S.W.) describes the experimental determination of the electrical resistance of wires made of different sorts of copper and its alloys. The author has found that, in general, minimum resistance is obtained on annealing in carbon dioxide at about 500 deg. C., and that a steady increase in resistance occurs when the wires are quenched from temperatures above 500 deg. C. This increase, however, tends to disappear when slow cooling is adopted or when the quenched wires are reheated at 500 deg. C. In wire-bar copper the increase due to quenching from 950 deg. C. varies from about 0.5 to 1 per cent. It is not greatly affected by variations in cold-drawing methods or by heat-treatment of the rolled rod before drawing.

With cadmium-copper, quenching from a high temperature does not increase the resistance to an unusual degree, but with fire-refined copper it causes an increase of nearly 10 per cent. Wires drawn from wire-bar copper that has been remelted under charcoal show a greater increase in resistance on quenching from a high temperature than those made from the original wire-bars. When, however, the remelting takes place in conditions that permit an increase in oxygen content, the resulting wires show only slight differences in resistance with variations in annealing treatment.

Additions of sulphur and selenium to copper of low oxygen content cause marked increases in resistance on quenching from high temperatures. In these instances the slowly-cooled samples contain numerous small inclusions, but the quenched samples are free from them.

A paper by Prof. C. O. Bannister and Dr. R. Rigby (Liverpool University) reviews the influence of light on electrode potential and corrosion phenomena of certain non-ferrous metals as determined by apparatus (which is described) that makes a continuous thread record of changes of e.m.f.

The influence of light is considerable in the cases of zinc and aluminium, aerated and illuminated electrodes becoming more markedly cathodic, but only in the presence of oxygen. This dependence on oxygen appears to indicate that the resulting change in e.m.f. is due to the catalysis of the formation of an oxide film under the influence of light, and that the most active light radiations are in, or near, the ultra-violet region.

A paper by Mr. S. C. Britton (L.M. & S. Railway Research Dept., Derby) outlines a test for zinc coatings on wires which has been devised so as to overcome the objections to tests based on chemical dissolution. Two steps are proposed. First, a stripping test designed to estimate the weight of coating which must be removed by uniform attack before the iron base is exposed, and then a wrapping treatment followed by a stripping test designed to gauge the liability of a coating to crack.

The stripping test is carried out by electrolysis in a specially designed cell, a fixed current density being employed so that each unit of testing time corresponds to a known weight of coating; at the end of the test, a short dip in copper sulphate solution serves to show whether the iron base has been exposed. The test is primarily intended to ascertain whether a coating meets a specification, but it can be used to determine the actual thickness of coatings. Potential measurements made during strippings provide information as to the structure of coatings. Thus, it has been shown that close-wiped coatings and "galvannealed" coatings consist almost entirely of zinc-iron alloy. Field tests are demonstrating that the test described gives satisfactory results for conditions of atmospheric exposure, while the Preece test has marked shortcomings.

* * *

Mercury-vapour Street Lamps

THE characteristics of the high-pressure mercury-vapour discharge lamp and its use for street lighting, as described in the paper by Messrs. G. H. Wilson, E. L. Damant and J. M. Waldram (G.E.C. research staff), and referred to last week, were discussed at the Institution of Electrical Engineers in London on March 5th. In introducing the paper Mr. G. H. Wilson remarked that, though the sodium-vapour type was the first to be used (abroad), since the first full-scale installation at Wembley three years ago 10,000 h.p. mercury-vapour lamps had been installed in this country for public lighting alone, apart from the large number now being used for indoor industrial lighting.

Mr. E. C. Lennox said that public lighting had not received the attention that it deserved from the I.E.E. While the light of these lamps had been described as blue-green, to the observer it appeared to be white and was a very excellent road light. Nearly all objections to it were due to bias or hostile propaganda. It was important to know that there was little to choose between light of different colours so far as fog penetration was concerned. Mains voltage drop had not caused any serious inconvenience in practice, but it would be useful to know the permissible limit. Colour correction was hardly worth while, except perhaps on promenades. It tended to introduce fragility and to increase maintenance.

The lanterns must be weatherproof. It had been found that at the mounting height of 25 ft. they were subject to a considerable amount of vibration and the glass tended to crack near the cap end. Should not the lamp have some extra support there? Discernment must be by silhouette background contrast, and the "spill" of light was usefully employed when it fell on buildings and side-fencing. Few public authorities could spend sufficient money to obtain the authors' optimum spacing, but with 150 ft. spacing h.p. mercury-vapour lighting cost £476 per mile against £704 or more for incandescent lamps. Mercury vapour was the best and cheapest form of road lighting and caused motorists quite naturally to switch off their head lamps.

Prof. E. W. Marchant declared that there was a good case for a contribution to be made from the Road Fund towards the improvement of public lighting. Electricity supply authorities might give some consideration to the fact that the street-lighting load came on at a time when other loads were not heavy. The h.p. mercury-vapour lamp was the nearest approach in efficiency to the flame arc lamp. The colour of the light did not matter; at the Public Lighting Conference at Margate it was not criticised at all. The use of these lamps had made silhouette much more sharp and had enormously improved driving conditions.

Mr. W. J. Jones (E.L.M.A.) remarked that the use of mercury-vapour lamps had fired public imagination and had helped materially to bring about the conversion of gas lighted streets. In this country 1,000 miles of roads was lighted by these lamps, more than the aggregate for the rest of the world. Economic aspects, with which the authors had not dealt, showed mercury-vapour lighting to be cheaper. A light output of 3,000 lumens per 100 ft. run was not reasonable. On main roads 400-W lamps should be used, for proper distribution demanded adequate sources.

Mr. H. Long said that when the lamps were used for interior industrial lighting there might be an initial outcry against the colour of the light, but objections were soon ceased. He did not agree with the authors' recommended positions for lamp-posts at road roundabouts. No light cut-off was necessary in cities where the surroundings needed to be illuminated, but he was not convinced that conditions did not differ on arterial roads.

Electricity Supply Costs

(Continued from preceding page)

irrespective of the individual load factor of those supplies and the resultant system load factor. In brief, it is the consumption per consumer that controls the total costs of supply after the cost of energy has been met.

The fall in total working costs with rising sales per consumer is very much more marked than is that of cost of energy. To illustrate this feature further, the representative undertakings were grouped according to the total working costs and the aggregate output of each group was divided by the total number of consumers supplied by that group. The result showed a very consistent decrease in costs with increase in the consumption per consumer.

Generation costs have already been taken in hand and will become standardised within limits, but distribution and selling costs call for an even greater measure of expert knowledge because of the greater diversity in the conditions appertaining to each area of supply. This should be given full consideration in any scheme of reorganisation.

Mr. T. N. RILEY considered that the authors had given too much attention to static conditions (stationary objects) on the road. They seemed to be overdoing contrast, for background might be made too bright for the eye to focus itself on the object. The alternative method of light distribution employed on the Continent had not been referred to. Had any tests been made of a car driver's reaction to an object suddenly moving out of darkness into the brightness of the road?

Mr. L. J. DAVIES said he had seen installations in the United States and on the Continent, and those in England were better than either, largely due to the excellence of the lanterns in which the lamps were enclosed. He emphasised the need to correctly plan each installation for every individual road; such planning could not be done on the drawing board. It was advisable to direct some of the light a little way down side roads.

Prof. J. T. MACGREGOR-MORRIS pointed out that some drivers maintained that when lamps were placed on the outside of a curve the shadow of the car darkened the inside curb. The vast majority was in favour of mercury-vapour lighting, but a few people maintained that it caused headache. That might be due to such light being confined to two lines in the spectrum. The effect of trying alternately to focus first on one line and then on the other would be eye-strain.

Mr. R. MAXTED referred to alternative methods of compensation for horizontal operation (see ELEC. REV., February 28th, page 309) and prism arrangement for light distribution. Only by making high road utilisation possible would the highest efficiency of the lamps be obtained. The light distribution characteristic was a good way of classifying lantern efficiency.

Mr. F. E. J. OCKENDEN said that mercury-vapour lighting had been employed quite extensively in drawing offices without causing headache. But such lamps emitted short waves and they might not all be eliminated by the glass envelope. Some people might be more susceptible than others. Mr. A. C. H. FROST considered that lamp-posts on the inside of curved roads might illuminate both curbs better than standards on the outside only.

Mr. G. S. C. LUCAS said that when mercury-vapour lamps were used in drawing offices their stroboscopic effect should be avoided by including some tungsten lamps. Was headache due to glare experienced when passing from one lamp area to the next? The power factor of an installation might be improved by using condensers and chokes on alternate lamps, but that would be more expensive than the present arrangement. Several other speakers asked questions.

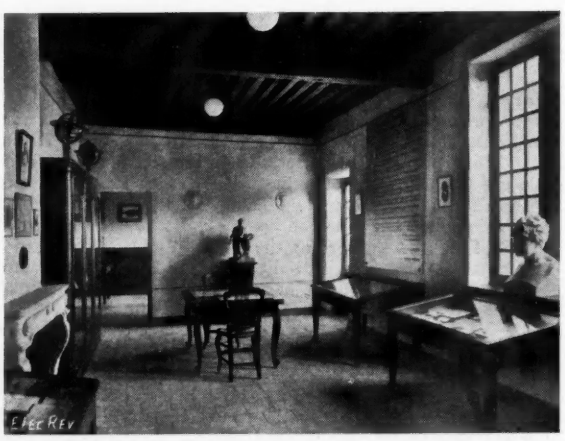
Mr. E. L. DAMANT replied to technical points raised during the discussion, while Mr. J. M. WALDRAM demonstrated the operation of h.p. mercury-vapour lamps and answered questions relating to installation planning.

The Ampère Centenary

LYONS, the town near which André Marie Ampère was born, and which, throughout his life, he considered as his home, has held a four-days' commemoration of his life and work on the occasion of the centenary of his death. The period March 5th to 8th was chosen so as to coincide with the Lyons Fair, which formed a background to the ceremonies, bringing out the tie between the purely scientific work of the originator, and the subsequent practical results. The life of Ampère was the subject of an article in our issue of January 24th.

An exposition of historical and technical interest took up a large section of the fair grounds and was divided into five sections. In the first were shown some of the most important electrical machines developed in the last century side by side with models and photographs of the most recently completed generating plants. The second was devoted to electricity in traction, the third to communications, the fourth to radiation and the more purely scientific aspects of the work of Ampère and his successors, while the last was given over to light.

The first three days of the congress were devoted to reports and papers, and the fourth to the solemn closing ceremonies. The papers were divided so that a particular branch of electricity was treated at each session. The first day's work was on the subject of lighting in all its forms. Road lighting progress, street lighting, shops and theatres came up for consideration in papers by experts in each of these lines.



The Ampère Room at the Polymieux Museum, near Lyons

The importance of the question of road lighting is shown by the fact that of the six papers on lighting, four dealt with the various phases of this question; these were read by Messrs. Commanay, Gibrat, Piraux and Saccarin.

At the evening session Monsieur Dutacq, of the Faculty of Letters, spoke on Ampère's life. He traced the unhappiness which followed the man from his youth when his father was guillotined by the revolutionaries, the early death of his wife, his second and most unhappy marriage, ending in divorce less than a year later, and his long struggle to find the means to continue his work, to his death in an almost indigent condition at Marseilles. This was followed by a lecture by Monsieur André Claude on modern electric lamps, illustrated by experiments. He spoke of his own work with krypton and xenon filled lamps.

The second day's papers were on the practical applications of electricity: traction and domestic applications in the morning, and industrial applications in the afternoon. The principal speakers were Monsieur Parodi, who spoke of the electrification of railways, Monsieur Soleil, who spoke of the electrical equipment of canals and navigable waterways, Monsieur Malegarie, who dealt with the development of domestic equipment and its importance in the modern home, and Monsieur Graveux, who reviewed the progress that had been made in the introduction of electricity into rural areas, and traced the social and economic changes that this had brought about.

The speakers at the afternoon session were Professor Flusin, of Grenoble, who spoke on the applications of electricity in chemistry and metallurgy, while Monsieur Gournier traced recent developments in the industrial applications of ultra-violet and X-rays. The remainder of the afternoon was given to three papers on telephone, telegraph and wireless, with some mention of recent work in television. In the evening a gala was held under the chairmanship of Monsieur Louis Lumière. This included, apart from a musical programme, a talk by Monsieur Bethenod on the inventions of Lumière, and one by Monsieur de Valbreuze, who spoke of the development of the electrical industry and its relation to the work of Ampère.

The speakers on the third day, which was devoted to the more purely scientific side of electricity, included some of the most noted of the living French scientists. Professor Langevin spoke on the relation between modern physics and Ampère's work, Monsieur Louis de Broglie on the evolution of the electron, and Professor Thibaud on the constitution of matter. The afternoon session was divided into two parts, one on the applications of electricity in medicine, at which the chief speaker was Dr. Belot, the other, attended by the main body of the physicists, continuing the work of the morning, heard reports by Prof. Perrin, president of the Academy of Sciences on molecular induction, and by Monsieur Maurice de Broglie on photo-electric phenomena.

At a special session on Sunday at the Opera House under the chairmanship of Monsieur Julien, the principal speaker, Monsieur de Launay, dealt with the life of Ampère as a scientist. This speech was followed by short speeches by delegates of the various foreign countries, and the sessions closed with a speech by Monsieur Herriot, Mayor of Lyons.

Institute of Transport Congress

The Institute of Transport is to hold its congress at Birmingham (May 20th to 23rd), under the presidency of Sir Cyril W. Hurcomb. One of the three papers to be presented will deal with municipal passenger transport, the author being Mr. A. C. Baker, general manager of the Birmingham Corporation Tramway and Omnibus Department, whose Tyburn Road depôt is to be inspected. A tour of the Witton works of the General Electric Co., Ltd., is included among a number of works visits, in addition to numerous excursions and social functions.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Professional Incomes

The phenomenon described by Mr. Scaife in your issue of March 6th is merely an illustration of monopoly revenue. The medical profession has a legal monopoly and can regulate the supply of practitioners so as to maintain a high average individual income. The profession of electrical engineering has no legal monopoly and if there are just sufficient qualified engineers willing to give their services for the figure mentioned to meet the demand for such services at that figure, then that will be the market value.

These remarks should not be construed as suggesting that the former practice is immoral, or even unnecessary, but only as a reply to Mr. Scaife's query. A. W. FISHER, A.M.I.E.E.

London, N.2, *March 9th.*

Inquiries into Failures

The leaderette "About a Breakdown" in the ELECTRICAL REVIEW of February 21st, directed attention to the importance of an official explanation being given when such failures occur.

In your issue of February 28th a very complete technical statement was given regarding the recent breakdown on the New York Edison system. A similar technical explanation should certainly be forthcoming regarding any serious failures of supply in England, which have been only too frequent during recent years. The daily Press could then give a more popular explanation for the general public. As you state, "The mystery that is allowed to surround them fosters the belief that electricity is inherently unreliable."

London, E.C.1, *March 6th.* A. S. HERBERT, M.I.E.E.

[Our leaderette referred to the breakdown of the supply to the Southern Railway, and we therefore think it due to the supply company concerned, the London Electric Supply Corporation, Ltd., to mention that at the company's annual meeting the chairman (Mr. O. R. H. Bury) said that they were in no way responsible for this breakdown. This, of course, does not invalidate our correspondent's contention, and the recent events at Bradford present a good case for a thorough inquiry and explanation.—EDS. ELEC. REV.]

Changing Over a Small Undertaking

In your issue of February 28th there is a very interesting article by Mr. A. J. Dalton under the above heading which deals with the change-over in the Borough of Dorchester. We should like to take this opportunity of informing you that practically the whole of the motors used in this change-over were supplied by us. The few exceptions were those where mechanical difficulties were so great as to necessitate the manufacture of special motors at a considerably increased cost.

In addition to supplying the motors, motor-generator sets, &c., for this change-over, a considerable portion of the installation work was undertaken by us with local labour. In most cases the existing machines were measured up and details taken by our engineers without disturbing the installation and the replacement a.c. motors were supplied and went into position with the minimum amount of fitting.

Our success with the motor portion of the contract was in no small measure due to the facilities and assistance provided by the Dorchester Electricity Department in taking measurements, etc., and also to the co-operation of the consumers.

HIGGS MOTORS, LTD.

Birmingham, *March 9th.* G. B. Richards, *Sales Department.*

Automatic Cooker Control

I would like to support Mr. A. D. Constable in his remarks regarding electric cooker control in the February 28th issue of the ELECTRICAL REVIEW. Recently several ladies have informed me that they are considering returning to gas cooking on account of the ease of heat regulation. These ladies were quite unaware of the fact that thermostatic control could be applied to electric cookers, and until manufacturers give more attention to this point I am sure that there will be many people taking the retrograde step of reverting to cooking by gas or other means.

I sincerely trust that the manufacturers will take note of these remarks and put the necessary machinery in action to provide all cookers with thermostats in the near future.

Wallasey, *March 4th.* (Mrs.) F. D. LARCOMBE.

Three-heat electric oven control is so superior to all other cooking methods that finer control is not needed. The control fitted to gas cookers is very necessary owing to the extreme pressure variations, but it does not control the temperature variations due to draughts that one encounters in practically all kitchens. With a non regulated gas cooker, the fact that a tap has infinite settings between the open and closed positions has little bearing on the matter when the gas pressure is so variable. In actual practice a three-heat electric oven has much less temperature variation than a "regulated" gas cooker.

It is often suggested that the thermostat compensates for voltage variations. The consumer is interested not in kWh but in the service he gets whether heating, lighting or power. In all cases this "service" for which he pays varies, not directly, but as a power of the pressure. I think we should guard jealously our high reputation and not put ourselves in the same category as the trader who gives short measure.

Much has been said of the added freedom that a thermostat permits the housewife. How many housewives go out or wish to go out at the time when the meal of the day is being prepared? Generally other duties, such as the preparation of the food, require their attention at these times.

With some ten years' experience of cooker hiring, during which time I have installed several thousand cookers, I have never had one back due to the oven control. The most unsatisfactory part of the cooker is the hotplate equipment, for this is very susceptible to pressure variation. I wonder how many engineers know the number of gas rings that are used with their cookers. We have high-speed plates that for normal quantities of three to four pints are slower than the slowest solid plates, and solid plates that are hopeless on any quantity under three or four pints.

A general view of the Preston electrical exhibition which was opened by Sir John Brooke on Monday last. A report of the opening ceremony appears on page 398

If designers would concentrate on improving the hob and its equipment, and engineers make some attempt to keep their system pressures within the legal limits, consumers' engineers would have difficulty in dealing with the increased demand.

Whilst cookers for sale or hire purchase may incorporate as many "gadgets" as the particular consumer is prepared to pay for, those for hire must be kept down in price. It is seldom that an economic rental is procured for a hired cooker.

Gloucester Electricity Dept. JAMES F. EDGELL,
March 6th. Consumers' Engineer.

Publicity—and the Domestic Load

The remarks of "Protonius" in your issue of March 6th under the above heading clearly call for a reply from me.

What your correspondent has entirely failed to appreciate is that I was not belittling the importance of domestic electrification; I was indulging in a mild and friendly criticism of the Electrical Development Association and what I consider its too great preoccupation with the household uses of electricity. Important as domestic supplies may be, they are, nevertheless, only a small proportion of the total output of the industry; and really cheap domestic supplies can only be based on a sound industrial backbone.

The present revival of trade in this country undoubtedly affords big opportunities for the increase of industrial supplies, and it seems to me that the Association is not devoting a proper proportion of its publicity work to this type of business. In this I am not referring only to propaganda for the benefit of the public at large but also to what would be an important branch of activity of the Association—publicity within the industry for the benefit of the many thousands of electrical engineers excluded from membership of the Association, but having a deep interest in its purpose and the capacity to help. F. C. WINFIELD.

Newcastle-upon-Tyne, *March 10th.*

Auxiliary Electricity Supply for Fire Engines

From the interesting account of the new Birmingham Fire Brigade Headquarters, in your current issue, it appears that supply for engine heating, etc., is brought by t.r.s. cables from ceiling points. There may be special reasons or arrangements favouring such a method in this instance, but, in the case of the Sunderland fire engines, supply is given *via* sockets and plugs at the rear of each vehicle, disconnection being effected automatically when each vehicle draws out. This simple and unobtrusive arrangement works well. G. E. M.

Sunderland, *March 10th.*

The Birmingham Electric Club

THERE were close on 400 present at the twenty-fifth annual dinner of the Birmingham Electric Club, which was held at the Grand Hotel, Birmingham, on March 6th. As the number of members is about this figure, the attendance, even allowing liberally for hospitality given to friends, is evidence of the very live character of the organisation.

In proposing the toast of "The Club," Mr. S. T. Allen (manager, Central England Area, C.E.B.) referred to the freedom from formalities in its constitution and the large contribution made by its members towards electrical developments in the district. He urged that the present prosperity and cheapness of money should not blind the industry to the need for planning for the remote as well as for the immediate future. The success of the whole electrical industry depended very largely upon the electricity supply section. He was still of the opinion that he had expressed twenty-five years ago that the domestic demand would be greater than any other. The water-heating load in individual units of from 5 to 20,000 kW (150,000 kW was obtainable in Birmingham alone) provided a promising field. One of the best investments would be in salaries of hundreds of good development officers—not mere canvassers.

Responding to the toast, the President (Mr. W. E. Clarke) reminded his hearers that the Club catered for the technical as well as the social interests of its members. In this way it had enabled many men who had been prevented by war service from receiving the training needed for membership of one of the senior engineering institutions to keep abreast of electrical developments. He referred to a scheme in hand for encouraging the sons and daughters of members to enter the industry. After congratulating the Corporation on changing over to electric lighting in some of its main streets, Mr. Clark deprecated the call for cheaper electricity, and suggested as a slogan for the industry "Electricity is cheap at any price."

The industry must be prepared to pay for brains for research as well as for manufacture if it was to meet foreign competition. He suggested that street congestion in urban centres should be dealt with by electric underground railways which should be subsidised by the Government for providing shelter for the public during air raids. If the railway companies would not electrify the local systems, the Corporation Transport Department should form a district transport board on similar lines to that in London.

Mr. H. Hooper (vice-president), proposing the health of "The Guests," expressed regret at the absence of Mr. E. F. Hetherington (manager, West Midlands J.E.A.) owing to ill-health, and of the Lord Mayor (Ald. Grey), Ald. Sir Percy Bower, Mr. F. Forrest, and Mr. E. J. Jennings, who were attending a banquet on the same evening in honour of Mr. Jennings on his forthcoming retirement.

Lt.-Col. J. T. C. Moore-Brabazon, M.P., replied on behalf of the guests. Recalling that Lord Kelvin had held that dynamic aviation was an impossibility, he urged electrical engineers not to give up attempts to provide a really efficient battery, which he believed would do more than anything else to revolutionise the industry. Fundamental research had affected even the philosophical outlook of the world and had destroyed materialism and the repugnant doctrine of predestination. Science must be servant, however, and not master—something to bring happiness into the lives of millions; it ought not to be debased, as aviation had been, into an instrument of destruction.

The President thanked Mr. J. Donovan (hon. social secretary) for his work in organising the dinner and also the enjoyable musical programme which followed.

Cheap Domestic Electricity

A FURTHER E.D.A. Survey has been made of the rates of charge in force at January, 1936, for general domestic service (*i.e.*, for purposes other than lighting). In the following tables figures from a previous survey (January, 1934) have been included for comparison purposes. The total number of houses surveyed was 11,396,543; of these 6,200,512 were supplied with electricity.

Rates of charge analysed in terms of houses whether connected or not, were as shown in the following table:—

General domestic rate per kWh.	No. of houses surveyed.	Percentage of total houses.
½d. and under	4,609,294 (3,472,113)	40.5 (33.5)
Over ½d. to ¾d. inclusive ...	3,356,476 (3,665,582)	
Over ¾d. to 1d. ,, ...	2,494,499 (2,219,041)	
Above 1d.	936,274 (1,022,436)	
	11,396,543 (10,379,172)	
Summary.		
¾d. or less	7,965,770 (7,137,695)	70.0 (68.8)
1d. or less	10,460,269 (9,356,736)	92.0 (90.0)

This analysis shows that approximately 10½ millions, *i.e.*, 92 per cent. of the total homes in Great Britain are in areas of supply authorities whose domestic rates are 1d. per kWh or less. Compared with the previous survey this shows that during the last two years electricity has become available at 1d. per kWh or less to over one million more households.

Of these 10½ millions, over 4½ millions (40.5 per cent.) have electricity supplies available at ½d. per kWh or less, to 3½ million supplies are available at over ½d. up to and including ¾d., and to the remaining 2½ million supplies are available at over ¾d. up to and including 1d. Thus summarised we find that to approximately eight million houses or 70 per cent. of the total homes in this country domestic supplies are available at ¾d. per kWh or less. These results show the considerable degree of uniformity which now exists in the price of electricity for general domestic service. The higher rates of charge naturally apply in rural areas where the cost of alternative means of heating and cooking is also higher.

In order to show that these rates of charge are available to those homes which are already connected to the mains a further survey has been made in terms of existing users as follows:—

General domestic rate per kWh.	No. of wired homes supplied.	Percentage of total wired houses
½d. and under	2,759,283 (1,654,591)	44.5 (35.6)
Over ½d. to ¾d. inclusive ...	2,028,230 (1,752,284)	
Over ¾d. to 1d. ,, ...	1,095,874 (916,571)	
Above 1d.	317,116 (330,560)	5.1 (7.1)
	6,200,512 (4,624,006)	
Summary.		
¾d. or less	4,787,522 (3,406,875)	77.0 (73.2)
1d. or less	5,883,396 (4,323,446)	94.9 (92.9)

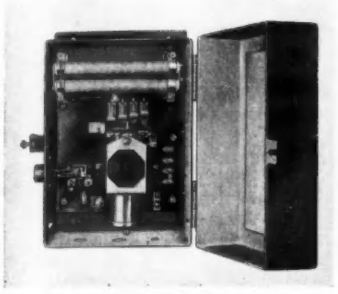
This analysis shows a still greater degree of uniformity of price as of existing electricity consumers only 317,000 or 5.1 per cent. need pay more than 1d. per kWh for their supplies. To upwards of six million wired homes electricity is available at 1d. or less. Of these six millions to 2,800,000 (44.5 per cent.) electricity is available at ½d. per kWh or less, to a further two millions electricity is available at over ½d. up to and including ¾d., and to the remaining million electricity is available at over ¾d. up to and including 1d. From this it will be seen that of existing electricity consumers 4,800,000 or 77 per cent. can obtain supplies for domestic purposes at ¾d. per kWh or less.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

D.c. Automatic Starters

A range of automatic d.c. starters suitable for machine tools, compressors, pumps, &c., up to 7½ h.p., 460 V, has been put on the market by the DONOVAN ELECTRICAL CO., LTD., 46, Great Charles Street, Birmingham, 3. They differ from others in that the action is delayed by an air dashpot, which is less liable to change with temperature than an oil dashpot. Furthermore, the switch action is vertically operated by a solenoid with no toggles or links to get out of line. The contact fingers are renewable in a few seconds without tools, the assembly is exceptionally compact, and a magnetic blow-out and thermal overload relay are fitted to all sizes.



A d.c. automatic starter

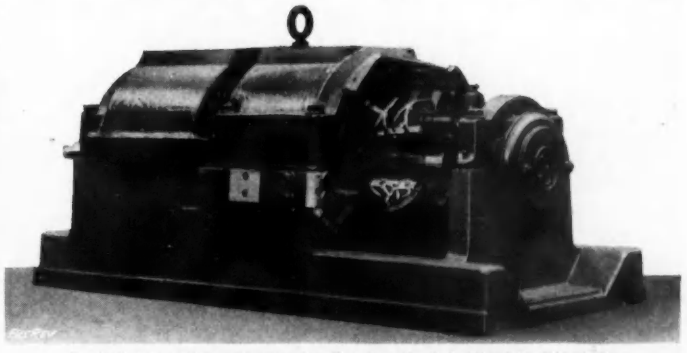
Air-cooled Two-stage Compressors

A range of compressors introduced by MESSRS. WORTHINGTON-SIMPSON, LTD., Newark-on-Trent, enables the two-stage cycle to be adopted for capacities of from 400 to 20 cu. ft. per min. The advantages of two-stage operation, with intercooling, for pressures above 60 lb. per sq. in., include saving in energy, which may amount to 15 per cent. at 100-lb. discharge pressure, and to higher delivery of pure air, 23 per cent. more at that pressure than that of a single-stage machine, but generally their greater initial cost for capacities of less than 400 cu. ft. has prevented their adoption. Typical examples are a two-cylinder machine of "V" design for sizes up to 80 cu. ft. per min., and a three-cylinder machine with a vertical h.p. cylinder and two inclined l.p. cylinders arranged radially about a common crank. Cooling of both intercooler and cylinders is by forced draught, and the discharge temperature at 150 lb. per sq. in. is said to be about 200 deg. F. lower than for a single-stage, water-cooled unit. As the running balance of the cylinders prevents appreciable vibration, only light foundations are required. Ball and roller bearings are employed. The lightness of individual parts permits even a 400-cu. ft. machine to be dismantled from floor level without the aid of lifting tackle.

The Worthington-Simpson compressor

Plating Motor-generators

A new line of motor-generators with outputs of from 500 to 2,000 A at 8 V d.c. for use on 50-cycle a.c. systems has been developed by the SMETHWICK ELECTRIC PLANT CO., LTD., Rabone Lane, Smethwick, Birmingham. Efficiencies of as high as 80 per cent. at 8 V and 70 per cent. at 4 V, obtained by shunt regulation, are claimed, with stable operation at voltages below 25 per cent. of the full value without separate excitation. The commutators, the peripheral speeds of which never exceed 2,100 ft. per min., embody a ventilating system of unusual construction; cantilever brush gear is fitted. The relatively heavy shafts are run in independent bearing housings. Removal of the top cover and pedestal caps enables the whole line of internal parts to be lifted for inspection.



A plating motor-generator by the Smethwick Electric Plant Co.

Lamp Novelties

MESSRS. I. & M. STEINER, LTD., 15, Bartholomew Close, London, E.C.2, have made two additions to their range of dry-battery operated novelty lamps which are illuminated automatically on lifting, by reason of button switches incorporated in their bases. One in the form of a house lantern is composed of bakelite with frosted-glass panels. The other is a table lamp with receptacles for cigarettes and matches, illuminated by four flame bulbs in spray formation. This is also constructed mainly of bakelite, which is available in practically any colour. In both models provision is made for switching on the lamps permanently if desired, and the base can be easily removed for renewal of batteries.

A Connectorless Iron

The connectorless iron made by the REVO ELECTRIC CO., LTD., Tipton, Staffs, has an unbreakable metal cover protecting the terminals. This is secured by means of a cable gland in the flexible spring sleeve and cannot be pulled out, there being ample ventilation to keep the cover cool.

Another feature of the iron is that it has no separate heel rest, the curved ridge at the base of the cover forming an adequate rest for the iron. The element is rated at 450 W, and 4-, 5-, 6-, 7- and 8-lb. sizes are obtainable. The standard finish is nickel plate, although chromium plate and vitreous enamel are also supplied; a heat indicator is another useful accessory which can be obtained built into the iron.

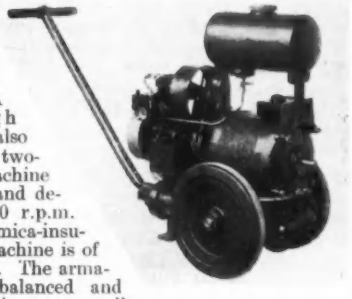
The Revo connectorless iron

A Petrol-electric Generating Set

A 400-W transportable petrol-electric generating set is being sold by the TARPEN SYNDICATE, LTD., 119-125, Finsbury Pavement, E.C.2.

This set comprises a 1 h.p. Hayward two-stroke engine direct coupled to a generator rated at 3.7 A at 110 V, although other voltages are also catered for. It is a two-pole shunt wound machine for continuous rating and designed to run at 2,000 r.p.m. The commutator is mica-insulated and the whole machine is of drip-proof construction. The armature is dynamically balanced and mounted on ball bearings; a small switch is provided on the front end of the generator so that the field circuit can be broken when it is desired to use the engine for other purposes. An automatic control is incorporated, shunted across the output. The armature is coupled to the carburetter control, the latter being held in the open position by a light spring. As soon as the engine is started and current flows, the armature moves and closes the throttle, but when a load is connected to the generator output the current is weakened and allows the throttle to open the required amount. The output from the generator is connected to an ironclad switch and socket mounted on the top of the machine.

The engine and generator are mounted on a specially designed chassis, the base forming the exhaust chamber to secure quiet operation.



The "Tarpen" generating set

D

Watertight and Flameproof Lighting Equipment

A wide range of watertight lighting equipment has been introduced by the Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3. In addition, there has been an extensive revision of the existing Simplex patterns, but in the main this consists of modification of the essential dimensions and the addition of cooling fins.

The flameproof floodlight projector (LS80), a wellglass lantern for armoured cable and (below) a medium range weatherproof floodlight projector

The new non-flameproof colliery lanterns and connection boxes are among the first to be placed on the market to comply with B.S.S. No. 238 for watertight lighting equipment for use in collieries above and below ground in positions permitted under the Mining Regulations. The lantern consists of a cast-iron body with generous finning, carrying a specially heavy wellglass, supported between heat-proof gaskets. The connection box meets the latest requirements of the B.S. Specification and incorporates the Simplex two-pole central spindle connections ready wired to the lampholder terminals in heatproof flexible cable.

A flameproof floodlight fitting made for narrow angle projection can be used in explosive atmospheres such as spray painting, body building, petrol plants, coal bunkers, &c., and also in ships where explosive cargoes are carried. For the latter application there is a special marine-type with a quickly detachable shoe-backplate.

The range of floodlight fittings also includes a general purpose type (Nos. LS50-59). A feature of these is that the full range of ten units is made up from interchangeable parts, reflectors, &c., making it possible to cover the whole field of normal floodlighting with a single range of fittings. Similar projectors are also available in a smaller size to take lamps rated at up to 200 W.

Other newcomers are medium range weatherproof floodlight projectors made in types to give a circular or elliptical beam. They are fitted with stepped-down dual-focus reflectors which give a more efficient light control than is possible with the ordinary plain parabolic type of the same dimensions. The lampholder, which takes 300/500-W lamps, is adjustable for focus.

15-A Switch-plugs

A new 15-A two-pin switch-plug with porcelain base is now obtainable in brown or white from the British General Manufacturing Co., Ltd., Brockley Works, London, S.E.4. In spite of its competitive price, it is robustly constructed and neatly finished, and the mouldings are particularly clean. It has knife contacts, a square dolly, and a "captive" cover. Features of the plug are a novel type of cord grip and a bevelled top, permitting easy withdrawal.

British General 15-A switch-plug

A Rubber Splicing Compound

The name of the makers of the "Slipknot" rubber splicing compound mentioned in our last issue is Rotunda, Ltd., not "Rotund, Ltd.," as stated.

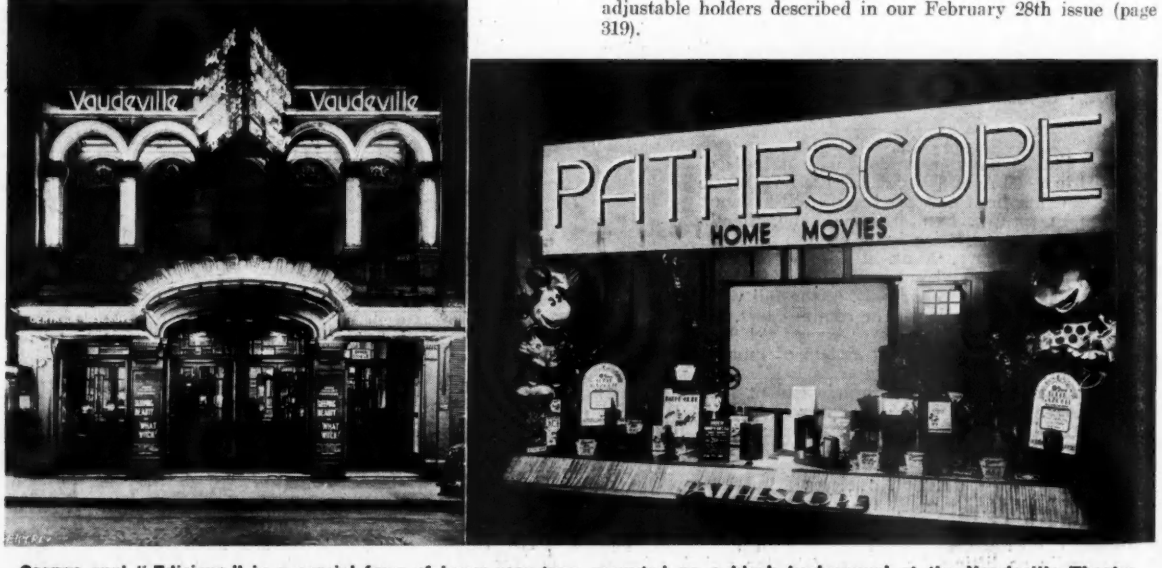
New Applications for Architectural Lamps

For theatres, cinemas, hotels, restaurants, shops, exhibitions and, in fact, all buildings where signs are used for advertising or display purposes, the new "Edisign" architectural lamps now available in sections to form letters and numbers have big possibilities. Although the standard height of the characters is 19½ in., the Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2, can supply them in any sizes, the colours obtainable being white, yellow, green, orange, pink, red and flame.

Though they have a larger current consumption than neon tubing, the new lamps give a much brighter light, which in many cases, especially for shop-window displays, permits other forms of illumination to be considerably reduced. Both initial and maintenance costs are low, new sections being easily fitted without disturbing the display.

Since they operate on all standard voltages "Edisigns" are particularly suitable for interior use and also are easily adaptable for animated advertising by means of automatic flashers or continuously operated dimmers. A feature, which is particularly important for exhibition displays, is that the light tubes can be used again for forming different words or the appearance of the sign can be quickly changed by inserting tubes of another colour.

Standard designs of wood and metal letters and numerals are obtainable for mounting the lamps, which fit into the adjustable holders described in our February 28th issue (page 319).



Orange opal "Edisigns" in a special form of lower case type mounted on a black background at the Vaudeville Theatre, London. The window of Pathéscope, Ltd., in the right-hand picture needs only three 100-W lamps to light it in addition to the orange "Edisigns"

Sharing Prosperity. By F. R. Jervis, B.Com.

APART from the psychological considerations of prestige which accrue to members of a successful industry, engineers to a certain extent share financially in the prosperity of the electricity supply industry. Where salaries are based on the rating of the generating station there is always the prospect that increased output will raise the rating of the station, and consequently the salaries of the people responsible for the advance. Moreover, a general expansion creates opportunities for further executive posts, with additional prospects of increase in salary. Admittedly there are anomalies, particularly where stations have to be closed down because of the concentration of production in certain selected stations; but anomalies no doubt exist in all professions.

The industry as a whole has benefited. Consumers are obtaining increased supplies at a cheaper rate, the executives are in a hopeful position, while the companies pay good dividends and the municipal undertakings contribute handsomely to the rates. Perhaps it is fitting to review the position of the average employé, and to see how the increasing prosperity affects him. To the rank and file employé may not be due the whole credit; perhaps, to a certain extent, it may be said that he is carried by the stream of general progress. Yet even if that be allowed, the work of the employé is *one* factor in the success of any undertaking—and recognition by the management of such personal factors leads to improvement in the internal efficiency.

The "Average Man"

How, therefore, does the expansion of the electricity industry affect the prospects of the ordinary non-engineering worker? It is true that there are prospects of promotion to the "non-commissioned" ranks. To secure efficiency of operation with increase in size, several departments will have to be subdivided into the various specialised functions formerly carried on in one department, and this sub-division will create opportunities for foremen and other sectional heads. But it is probably true that the hope of promotion operates less in the lower ranks than it does in the higher; for this reason the prospects of gain are materially less, and, moreover, the scope for advancement is more limited.

There is no reason why a person of exceptional ability should not rise in the electricity supply as in other progressive industries, but such people usually take care of themselves. Leaving out of account such opportunities which probably have little actual influence on the average employé, it can be seen that his personal interest is definitely limited. Where an undertaking doubles its output practically the only material satisfaction gained by the men is that the tenure of their employment is more secure. With additions to staff, the existing members know that they will not be faced with the prospect of staff reductions and dismissals. Even this inducement will have less effect in a municipal undertaking, where there are other departments capable of absorbing redundant labour in case of need.

The present developed study of industrial psychology is particularly concerned with the problems of incentives in industry. It is recognised by successful industrialists as well as psychologists that an industry which hopes to obtain the best out of its workpeople must appreciate the point of view of the individual. It must do something to reward efficiency so as to encourage its existence. It can hardly be said that the electricity industry satisfies this canon.

Stimulating the employé's interest

Profit-sharing schemes have been tried as a means of increasing the interest of employés. Some have failed because they were not devised on the right lines, or because of apathy on the part of either the management or the staff. One of the chief drawbacks is that the share of the profit is paid yearly or half yearly with the ordinary dividends, and during the rest of the year the reward appears too remote. Another very important difficulty is that trade depression may reduce profits, just at the time that employés are expending greater energy on behalf of their firm. Nevertheless, there have been successful schemes, *e.g.*, in the gas industry.

One possible difficulty in the case of a municipal undertaking is that employés in the Electricity Department may be engaged under the same or similar conditions of service as men in other, non-trading, departments, where different conditions of efficiency may be observed. That would certainly present difficulties because of possible rivalry between various corporation activities, but there is no reason why more of the large company undertakings should not develop the idea more than they have done in the past.

Where profit-sharing is impracticable, other schemes for encouraging and rewarding efficiency may be applied. The commonest of all is the payment of commission for orders received. Where undertakings are selling appliances, this method is one which can give good results to the undertaking and to its employés. But there are many ways in which employés may increase the efficiency of their undertaking and yet have no tangible proof in the way of sales of apparatus. Many corporations do not actually sell appliances. While commission on hired appliances is a means of developing that side of the business, there are many pieces of apparatus having a strong effect on load-building which are not dealt with directly by the supply authority.

Influencing Business

Although it is the contractor's business to sell such appliances as irons, vacuum cleaners, wireless sets, &c., many consumers are more easily influenced by what they would regard as disinterested advice emanating from their own electricity showrooms. Therefore, people in a showroom or office are in an excellent position for furthering the sales by outside contractors of goods which have a considerable indirect influence on electricity receipts. Without attempting any dogmatic suggestions in this direction, it is believed that the management of the electricity supply industry is capable of devising some scheme whereby development will be greatly assisted.

A plan which is being increasingly developed in America is to have consumers' representatives, whereby one man is responsible for all work connected with consumers in a particular area—meter reading, complaints, development, &c. He represents the company in all matters; in fact, to the consumers in his district he *is* the company. With some such method it would be easier to adopt a system of payment by results, whereby virtue would have its pecuniary reward.

It is believed that if as much thought were applied to the study of the human factor as to purely engineering matters the future of the industry would be even brighter than it is.

The Census of Production

THE 1936 census covering the production of practically every trade with some manufacturing process during the year 1935, will be the most comprehensive taken since powers were given to the Board of Trade by the Census of Production Act, 1906. Powers for the taking of surveys are also given by the Import Duties Act, 1932, under which a list of trades affected must be gazetted. For this census all dutiable goods coming within the Import Duties Act and every other duty-imposing measure have been listed. The Census of Production Act covers all trades within the scope of the Factory and Workshop Acts and any other trade specifically mentioned by the Board of Trade, but the census applies only to goods where there is some process, such transactions as merchanting and factoring being excluded from the returns. An important point to note is, however, that the Factory Acts extend to operations such as making, altering, repairing, ornamenting, finishing and adapting an article or part of an article.

The information asked for is nearly the same under both Acts, being quantity and cost of materials used and of fuel and electricity consumed, and quantity and value of output with numbers of employés. Under the Census of Production Act further questions considered necessary to simplify the taking of the census can also be asked, with the exception of those relating to the amount of wages paid. Every firm will doubtless receive a form of return, but if the total of persons employed (including heads of firm and clerical staff but excluding those concerned with merchanting and factoring) did not, on an average, exceed ten during 1935, the full detailed replies are not required, but Part A (declaration of accuracy of information) and Part B (nature of business and the number of persons employed) must be completed and the form returned.

Import Duties Act forms will be received by most firms, as most goods are now dutiable by our tariff system, but a form under both Acts is not required unless there are non-dutiable goods in a firm's production, when a return under the Census of Production Act would also be required for these. Even so, if the return refers to one establishment, the Board of Trade will accept just the one Import Duties Act form, with any non-dutiable goods included, if the return is declared to cover all the goods of that establishment under the survey.

The object of the survey is to secure general information relating to industries of the United Kingdom, but the Govern-

ment is prohibited from publishing any individual return and every person engaged on the census must make a declaration of secrecy, anything divulged wrongly being punishable by fine or imprisonment or both. On the other hand, the making of returns is obligatory on employers under penalties, and forms must be returned within three months of the date sent. The year of survey is the year ended December 31st, 1935, but if any firm has another financial year ending date, that can be substituted, provided that it is not before April 7th, 1935, or after April 8th, 1936.

One question relates to the number of employés on one date in each month of the survey year, and there is a sample date (for this trade field October 12th, 1935) when the totals must be given apportioned as to "workpeople-wage earners" and to "administrative, technical and clerical staff," and divided also as to males and females and persons under 18 years and of that age and over.

With regard to output, the descriptions of goods are printed on each form, and where these are relevant to a firm's production, the only entries required are the total net selling value in pounds, and quantities where necessary. There is, however, a space for miscellaneous goods also, in which descriptions can be entered.

The Census of Production Act specifically includes persons engaged by way of trade or business in telegraphic, telephonic or electric line works. Furthermore, that Act states that the exercise and performance by a local or other public authority of the powers and duties of that authority shall be treated as the trade and business of that authority. The relevant forms for the electrical industry are: Electrical Engineering Trades, No. 51, and Electrical Undertakings, No. 172.

The following may also be of interest to many electrical firms: Scientific Instruments, Apparatus and Appliances Trade, No. 165; Musical Instruments Trade, No. 161; and Motor and Cycle Trades, No. 53.

Electrical Wholesalers' Dinner

THE annual dinner of the Electrical Wholesalers' Federation was held on March 5th at the Savoy Hotel, London, and was presided over by Councillor J. W. Mayall (president). After the loyal toast, the health of the "Electrical Wholesalers' Federation" was proposed by Mr. H. G. Williams, M.P., executive director of the Incorporated Association of Electrical Power Companies, who said that he first entered the distribution side of the electrical industry in 1901, and after some years in political life returned to the distribution industry about two years ago.

Electrical wholesalers were immune from public criticism, most of which fell upon the supply industry. He suggested that it was important for the various branches of the industry to co-operate and present a united front to the world, whatever their differences. He outlined the rapid growth of all branches of the industry and said that the past year had been a year of many records. It was a year in which the largest quantity of goods was produced in this Island, the largest number of people on record had jobs, and though we were a protectionist country, the quantity of goods imported was the highest in our history. The world was marching back to prosperity and this country was leading the way.

Mr. Mayall, who responded, said it had been a strenuous year in a quiet way. They had feared difficulties which, as the year progressed, did not materialise. There was less apprehension that one side of the industry would try to steal a march on the other and there was a greater spirit of co-operation. Manufacturers' organisations had consulted the Federation, which had helped to reduce their problems materially and had lent them assistance in relation to selling and distribution.

He referred to the Fair Trading Policy which he trusted would have the success it deserved. Many hoped great things from the McGowan Committee. It would be a godsend if electricity could be taken out of the political arena into which it had fallen. He wished that the industry had more men in Parliament who would stand up for free trading in the industry.

Mr. A. Albrecht, director of the E.W.F., proposed the toast of "Kindred Associations," and said he appreciated the excellent spirit which permeated the various trade associations in the industry. This growing spirit indicated increased confidence in each other and that each party realised that the other was entitled to a fair deal. He could promise that the Federation would do its share in promoting the welfare of the industry as a whole. He hoped that none would be carried away by the armaments boom. Left alone the electrical industry would continue to expand steadily, but the effect of the armaments boom would undoubtedly be to retard its normal growth.

Col. Sir Thomas F. Purves, director of the Cable Makers' Association, in reply said that goodwill was a matter of great importance to the C.M.A., and he hoped there would be many opportunities for their associations to act together. He paid a tribute to the example set by Mr. Ll. B. Atkinson, his predecessor, who was one of the great peace-makers of the industry.

Mr. A. G. Bruty (president of the Electrical Contractors' Association), who also responded, said that goodwill was the only basis for prosperity. The E.C.A. had always preached the gospel of goodwill and co-operation, and it was anxious to combine with others to spread the electrical idea; it had some thousands of members who were constantly bringing the electrical idea before the public.

During the evening, Mr. Mayall, on behalf of the Federation, presented Mr. George Donovan with a grandfather clock, as a token of their esteem on his retirement from the Council and committees of the Federation.

Croydon Corporation and Contractors

CROYDON electrical contractors have gained some important concessions as the result of their protest against the competitive trading proposals of the Croydon Corporation Electricity Committee. At its meeting on Monday the Council adopted recommendations which modified the original proposals in favour of the views of the contractors, while not meeting all their objections.

The contractors claimed that they were taken unawares when the Council, in July last year, decided to sell apparatus stocked in the municipal showroom direct to the public and to undertake the wiring for such appliances. This represented a reversal of the policy which was adopted eight years previously, by agreement with the contractors. At the first opportunity the contractors registered a protest against the development, and as a result the operation of the new system was deferred until the Electricity Committee had consulted the contractors.

The recommendations submitted by the Committee on Monday were the outcome of these negotiations. In effect, they were the following: That the showroom shall be stocked by the Corporation and not, as in the past, by the contractors; that sales, other than those on hire-purchase terms, shall not be made by the Corporation direct to the consumers, except in the case of special plant not normally dealt with by contractors; and that wiring shall not be undertaken by the Corporation unless it is incidental to the installation of apparatus hire-purchased or hired, and then not if the business is introduced by a contractor. The contractors, added the Committee's report, accepted the recommendations generally, but did not agree to the hire-purchase by the Corporation of vacuum cleaners or any apparatus costing less than £5, or for a longer period than two years, nor did they agree to the Corporation's doing any wiring.

Mr. L. C. Penwill, director of the Electrical Contractors' Association, was the spokesman for a deputation of the contractors received by the Council. He explained that they objected to the setting up by the Corporation of an installation department, in competition with contractors. Wiring work in connection with the Council's rental wiring scheme had been efficiently carried out by the contractors, who were obviously competent to undertake whatever further work was necessary. The best interests of the public and the expansion of the department would be served by leaving the contractors to carry out the work without unnecessary competition from the Corporation. If the Council decided to go on with its hire-purchase scheme the facilities it offered should be on a commercial basis. If terms in excess of what was fair commercially were offered, it was obvious that the traders would be unable to compete. So far as vacuum cleaners were concerned, Mr. Penwill contended that Croydon was already too well served by the "everlasting army of canvassers."

Moving the report, the chairman of the Committee (Coun. A. L. Boddington) said that there was nothing new in the hire-purchase proposals. They were anxious that the consumers should have the greatest possible facilities for the use of electricity. The Committee had done much in trying to meet the views of the trade, and the only concession that the trade had made was to allow the Corporation to stock its own showroom. By recommending the Council not to sell articles from the showroom for cash the Committee felt that it was leaving to the contractors the cash trade, which they said was essential to their well-being.

Coun. E. E. L. Arkell seconded the adoption of the report, but its reference back was moved by Coun. Major F. W. Rees on the ground that what was proposed was a definite and determined effort to extend municipal trading, to which he was opposed. The Committee's proposal meant giving the system an impetus which would be very far-reaching and disastrous. He also criticised the Committee's scheme for the reason that the department wanted to be both wholesaler and retailer, employing the capital produced by the Croydon ratepayers at the expense of the small trader. Seconding, Coun. C. H. Gibson said it was the object of the Corporation to supply electricity and not to go into details. Coun. H. T. Muggeridge, a former chairman of the Electricity Committee, said the real municipal trading began when the Corporation put down a generating plant. The Council now had to decide whether the interests of the undertaking, which belonged to the community, should be subordinated to the desire for small, petty things on the part of the contractors.

The amendment was rejected, and the report of the Electricity Committee was then carried.

Parliamentary News (BY OUR SPECIAL REPORTER)

IN the House of Commons on March 4th Mr. Wakefield asked the Under-Secretary of State for Air what progress had been made in the equipping of this country with radio beacons.

Sir P. Sassoon said it was not considered that the general equipment of aerodromes with radio beacons was yet justified at their present, and still experimental, stage of development. Certain technical problems, including questions of wireless control, still remained to be solved in connection with their use and international agreement had not yet been reached as to the systems and wavelengths to be employed. There was however, an installation at Heston aerodrome (described in our February 28th issue), and three new installations of different types would shortly be available for comparative trial at Croydon.

Unemployment Due to the Bradford Breakdown

Mr. Holdsworth asked the Minister of Labour if any provision existed within the Unemployment Insurance Acts to prevent hardship in respect of the statutory waiting period in the case of those men and women thrown out of work by the recent failure of the electricity supply in Bradford.

Lt.-Col. Muirhead said that the provisions of the Acts with regard to the requirement of a waiting week applied to all cases, subject to the rules as to continuity of unemployment, and there was no authority to dispense with this requirement in particular cases.

Validity of Meters

Mr. Ede asked the Minister of Transport if his attention had been called to a recent decision of the courts casting doubts on the validity of a number of meters now installed on consumers' premises by electricity undertakers; if he had consulted, or been consulted by, the Electricity Commissioners thereon; if representations had been made to him from any other quarter; and what action he proposed to take.

Mr. Hore-Belisha said that a Bill dealing with this matter, introduced by Mr. H. G. Williams, received a second reading on February 25th and had been referred to a Committee of the whole House.

The McGowan Committee

Mr. Ede asked the Minister of Transport if the Committee inquiring into the distribution of electricity had yet completed taking evidence; when it last met; when it would next meet; and when he expected to be in possession of its report.

Mr. Hore-Belisha said that the answer to the first part of the question was "No"; to the second part, February 28th; to the third part that the Committee was in frequent session; and to the fourth part that he could not say.

Interference with Broadcasting

On March 9th Mr. Temple Morris asked the Postmaster-General what steps he proposed to take to oblige the providers of domestic electrical appliances in this country to produce apparatus which conformed to a satisfactory standard of non-interference with broadcasting reception; and if he could make any statement as to recent progress in this respect.

Major G. C. Tryon said that at present he had no statutory power to compel providers of domestic electrical appliances in this country to arrange that apparatus provided by them should conform to a satisfactory standard of non-interference with broadcast reception. The whole question was under consideration by a Committee appointed by the Institution of Electrical Engineers, on which the British Broadcasting Corporation and the Post Office were represented, in addition to the electrical and wireless interests concerned. The Committee had issued an interim report, and in co-operation with the British Standards Institution a Specification for suppression apparatus had been issued and was available to manufacturers. Certain general questions, however, which had an important bearing on the problem were still the subject of consideration by an international committee. The question whether there was any need for legislation would be considered when the I.E.E. Committee's final report was received.

In the Courts

IN the Chancery Division on March 6th Mr. Justice Bennett had before him an application by Hoover, Ltd., for an interlocutory injunction restraining, until the trial of the action, Air Way, Ltd., Baker Street, London, from infringing the plaintiffs' trade mark "Hoover," and from passing off suction cleaning machines not made by them as Hoover machines.

Mr. Whitehead, K.C., for the plaintiffs, said that the defendants had advertised for sale what they described as "Hoover vacuum cleaners," and they sold to a Mr. Cook a machine which they represented as a Hoover machine. The plaintiffs found that this machine contained a number of important parts not manufactured by them. The evidence was that the machine was in a dangerous condition. The bag on the machine had not been made by Hoover, Ltd., although it bore their trade mark, which was also on the machine.

Mr. Trevor Watson, K.C., for the defendants, said there was a trade in re-conditioned machines and the plaintiffs were trying to get the whole of that trade into their own hands. Mr. Whitehead said that that was not so. The plaintiffs did not complain about re-conditioning, but about the machine being made with the trade mark.

His Lordship said that so far as the alleged infringement of trade mark was concerned he was not going to decide anything on that motion.

Mr. Trevor Watson said that all that was complained of by the plaintiffs was the use of the trade mark on the machine as a whole. It was said that that indicated that the machine and all parts were manufactured by the plaintiffs. The defendants had used the mark on certain goods. The question was whether these goods were the plaintiffs'. As he understood it, it was alleged that if there had been an alteration of a single screw the use of the trade mark would be an infringement. No decided case had ever gone to anything like that length.

His Lordship said that he was not prepared to grant the plaintiffs any relief on an interlocutory application on that part of the motion which dealt with the contention that the defendants had been guilty of passing-off machines not of the plaintiffs' manufacture as the plaintiffs'. He would, however, grant the plaintiffs the relief for which they asked in respect of the alleged infringement of their registered trade mark, and the injunction in that respect would be to restrain that infringement until the trial of the action or further order. The costs would be costs in the action.

Mullard v. Philco and Others

In the House of Lords on Monday the hearing was commenced of an appeal by the Mullard Radio Valve Co., Ltd., from a judgment of the Court of Appeal affirming a judgment of Mr. Justice Farwell in the Chancery Division and dismissing the action which the appellants brought against Philco Radio and Television Corporation of Gt. Britain, Ltd., George Robinson & Son, Ltd., and London Piano and Radio, Ltd., for an injunction (and the usual ancillary relief in a patent action) to restrain the alleged infringement by the defendants of the appellant company's letters patent No. 287958, dated December 24th, 1926, relating to an invention for "improvements in or relating to circuit arrangements and discharge tubes for amplifying electric oscillations."

Mr. Justice Farwell, who tried the action, held that the appellants' first claim was valid, but he dismissed their action on the ground that claims 2 and 5 were invalid for want of subject matter and holding that as the real issue in the case was whether claim 2 was valid his decision on claim 2 must decide that on claim 5.

The Court of Appeal on the appeal of the Mullard Co. from that result dismissed the appeal, holding that Mr. Justice Farwell was right in deciding that the Mullard Co.'s claims 2 and 5 could not be maintained and that their action failed and should be dismissed with costs. From this result the Mullard Co. now appealed to the House of Lords.

Sir Stafford Cripps, K.C., opened the case for the appellants, and the arguments are expected to continue for several days.

Fraudulent Use of Electricity

On March 3rd, George Hockham, Shalden, was charged with the fraudulent use of electricity contrary to Section 10 of the Larceny Act, 1916. The defendant had attached lamps to heating points through multiple adaptors and had also caused a cable to be run from the cooker control panel to two heating points to which certain lamps in an outhouse were attached. He stated that the lamps were only used for grading and testing eggs, and that he believed he could properly use the supply for that purpose. The lighting and heating points were the property of the supply company under a slot meter installation. The magistrates found the defendant guilty and fined him £7.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Siemens "Xcel" Arrangement Terminated

The arrangement by which Siemens Electric Lamps & Supplies, Ltd., acts as sole distributor for "Xcel" electrical domestic appliances manufactured by the Automatic Electric Co., Ltd., will terminate on March 31st next. After this date the sale of these electrical and industrial appliances will, except as mentioned below, be handled by Elexcel, Ltd., a company formed by the Automatic Electric Co., Ltd., to carry on the business of manufacturers and dealers in such appliances, which will, as hitherto, be sold under the trade name of "Xcel." Siemens Electric Lamps & Supplies, Ltd., will continue to market a full range of electrical domestic appliances, which will be sold under the trade description of Siemens. It will complete any unexpired contracts it may have for "Xcel" electric appliances and will continue to sell these appliances until its present stock is exhausted, and will also be in a position to supply thereafter any spare parts which may be required for any such appliances as it may have supplied in the past.

Municipal Trading in New South Wales

A conference of representatives of various municipal electricity supply authorities in New South Wales was convened at Sydney to discuss the question whether Councils should be permitted to engage in the sale of electrical appliances. Mr. Spooner, the Minister for Local Government, opened the proceedings and said that unless the interests concerned could reach a compromise the Government would have to decide whether the present position should continue or some alternative be adopted. He proposed to have the matter discussed by the Cabinet in the near future. He reminded the conference that in other directions the Cabinet's policy was to encourage private enterprise. Mr. C. M. McDonald, representing the Employers' Federation and other interests, said they were opposed to government or quasi-government trading, and he refused to accept any compromise. On the motion of Councillor Lloyd, M.L.A., a resolution was carried appointing a small sub-committee of representatives of supply authorities and private interests, to meet with a view to examining any scheme that might be brought forward and to report to a later conference.

An Aid to Scientific Marketing

Large-scale production of commodities involves the scientific study of markets to ensure that a demand exists, or can be created, and to enable the best distribution methods to be adopted. This means that reliable statistics must be available to give some sort of a picture of the possibilities. Such statistics must be sought in many directions, and when collected must be sorted out and put into intelligible order if they are to be of use to the commercial man—a task which can only be successfully done by those experienced in market research. A most valuable work of this nature has been published this week by Messrs. George Allen & Unwin, Ltd. ("The Home Market," by Major G. Harrison and F. C. Mitchell, 10s. 6d. net). In this, by means of statistical tables, maps and Neurath pictorial diagrams, the authors present in a fascinating manner vital facts relating to the distribution of the country's population and purchasing power. Regional surveys give particulars of such matters as density of population, the age and sex composition, and poor relief and unemployment. Social grades, sizes of families, analyses of expenditure and many other relevant subjects are covered, making the work an admirable sociological, as well as purely commercial, work of reference.

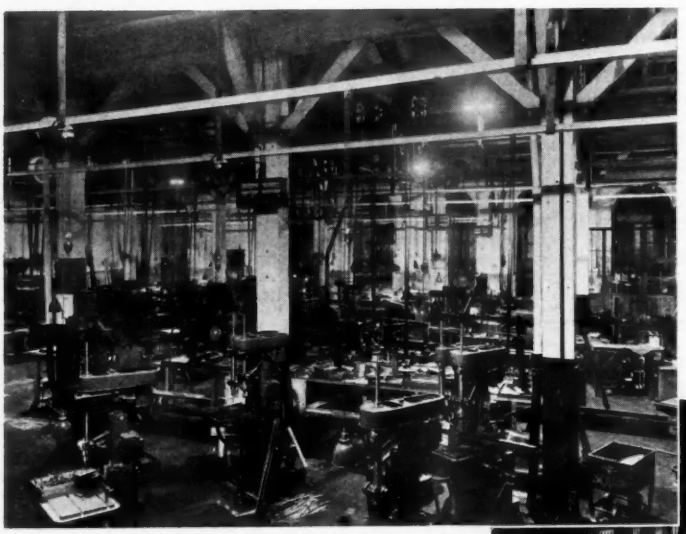
Lamp Works in the Dutch East Indies

A scheme for the establishment of an electric lamp works in Cheribon is being promoted by a Chinese combination. The Batavia *Nieuwsblad* states that the combination already has a lamp factory outside China. The machinery is reported to have been obtained from Japan, but difficulties exist in obtaining skilled labour in the Dutch East Indies, so that in all probability it will have to be obtained either from China or Japan.

Siemens Works Lighting

Messrs. Siemens Bros. & Co., Ltd., have recently installed "Sieray-Dual" lamps in their Woolwich works for improving the lighting, and an impression of the excellent effect obtained is gained from the accompanying illustrations. The upper picture shows part of a machine shop in which telephone components are made, the 500-W "Sieray-Dual" lamps being mounted in dispersive reflectors approximately 25 ft. above floor level. Each individual machine is equipped with a local lighting unit, but in practice it is found that these are very seldom used as the main lighting is so evenly distributed and casts very little shadow.

The other picture shows one of the cable testing and armouring shops, the 500-W lamps being mounted in dispersive reflectors above the crane track and approximately 30 ft. above floor level. As will be seen, ample lighting is provided, which is a very important matter where heavy articles are being moved about. Here connections are made for testing dry core telephone cables, the identification of colours being of primary importance.



Part of the machine shop and one of the cable testing and armouring shops of Messrs. Siemens Bros. & Co., Ltd., which are lighted by means of "Sieray-Dual" lamps

E.D.A. Activities

The London and S.E. England Public Speaking Competition was held at Savoy Hill, W.C.2, on March 3rd, and showed that the standard of these talks is steadily improving. The winners of the men's competition, which was judged by Messrs. W. L. Randell, J. Spence and G. S. Francis, were Mr. L. F. Ramseyer (first prize) and Mr. R. H. Fell (second prize), both of the North Metropolitan E.P.S. Company, who chose for their subject "The Influence of Electricity on Health."

The ladies' competition, which was held in the afternoon, was judged by Mrs. A. C. Cramb, Mrs. Pender Chalmers and Mr. G. S. Francis, and the winners were Miss

M. Thomason, of the North Metropolitan Electric Supply Co. (first prize), and Miss J. Smith, of the Croydon Electricity Department (second prize), who spoke on "How Electricity Helps the Farmer." The National Final Competitions, when all the Area finalists will meet, will be held in London, at the Charing Cross Hotel, on March 31st.

In sending us recently a selection of new advertisements which are appearing in the national daily and weekly newspapers, E.D.A. intimated that it had prepared a series of advertisements which had been designed to enable members to link up their own advertising with the national effort. We have now received a folder from the Association containing examples of these advertisements which closely follow upon the lines of those for the national campaign, space being provided for members' names and addresses.

A Buyers' Guide for Ironmongers

The Electrical Section of the Ironmongers' Federated Association has published for its members' use a guide to supplies of electrical appliances and equipment. The suppliers whose names are included are said to have given the Committee assurances that they are prepared to allow members of the Section terms as good as those available to any other class of buyer; that they will do all in their power to help the maintenance of reasonable prices; and that their goods are electrically sound and that they are prepared at all times to safeguard the user. In a foreword the secretary states that "the present is a critical time for the electrical ironmonger. . . . It is highly desirable that in their own interests, electrical ironmongers should show the strength of their organisation and their firm determination to combat, by all legitimate means, any attempt upon their electrical trade." The list is arranged in two parts: the first sets out the names of the suppliers who have given the above-mentioned assurances and the second classifies equipment and gives the names of the suppliers of each class. It is not suggested that the names in the list are the only ones who are favourable to the electrical ironmonger and a further and greatly enlarged list is foreshadowed.

Recent Contracts

Among the orders received by International Combustion, Ltd., during February were a number for plant for power stations. These included two stoker-fired boilers for Hams Hall power station, Birmingham, ash-handling plant for Fulham power station, and stokers for the Barton and Thorpe power stations and also for the Hyderabad Electric Supply Co.

Messrs. Crompton Parkinson, Ltd., have received an order, amounting to approximately £15,000, for the main switchroom equipment to be installed at the new University of London buildings in Bloomsbury. The order comprises eighteen fully interlocked draw-out truck-type cubicles, fifty-eight fully interlocked stationary type cubicles, forty-six industrial type ironclad units, one combined cubicle and desk type control switchboard, and interconnecting cabling. The order is being carried out by the Contracts Department of the company to the plans of Mr. J. Stinton Jones, who is the consulting engineer.

Neon Installations on Vehicles

Four service vans have been equipped by the Franco-British Electrical Co., Ltd., with red neon signs on each side, a blue box-sign on the front, and a reflex sign on the back. The signs on the side, which are of "Staybrite" steel with single-line tubes semi-recessed, measure 5 ft. long by 1 ft. 8 in. deep. The single-sided front sign is 2 ft. 6 in. long by 8 in. deep with the lettering sand-blasted into the glass and the tubes mounted at the back of the letters. A 1-h.p. two-stroke engine, inside the van behind the driver's cab, is direct coupled to a 230-V 50-cycle generator. No failure or breakage of any part of the neon installations has been reported after prolonged tests over rough roads.

Garage Lighting

The Edison Swan Electric Co., Ltd., has completed an attractive scheme of external lighting at the Lex Garage, Great Windmill Street, W.1. This five-floor garage holds 1,000 cars and offers many facilities to its clients. The tower of the garage has been floodlighted with Ediswan "Sirious" floodlights, employing "Escura" electric-discharge lamps. A 22-ft. high letter sign, "Lex," has been placed on the tower. The outstanding feature of the scheme, however, is the lighting of the twenty-one windows of the main building. These have been fitted with special "Accordo" blinds, floodlighted from inside by 4-ft. orange Ediswan architectural lamps, in chromium-plated trough reflectors. The result is a series of alternate ribs of light and dark orange colours, resembling a modernistic Venetian blind.

The "Lex" Garage lighted by means of Ediswan lamps

A Cable Works Brochure

We have received from Messrs. W. T. Glover & Co., Ltd., a well-produced brochure containing a selection of excellent illustrations of its works, which give a general idea of the range and variety of the processes used in the production of cables. A foreword outlines the company's progress from the foundation of the Salford works in the 'sixties by Mr. W. Glover for the construction of braiding and cording machines to the present works at Trafford Park, Manchester, which covers twenty acres and employs 1,000 people.

American Refrigerator Sales

According to the February *Bulletin* of the Edison Electric Institute the number of household electric refrigerators sold in the United States during 1935 was 1,590,023, as compared with 1,372,526 in the preceding year.

A Directory of Coventry Manufacturers

The Development Section of the Coventry Corporation has issued a "Directory of Coventry Manufacturers" (price 2s. 6d.). This directory has been published with the object of introducing Coventry manufacturers to new customers both at home and abroad, as a means of encouraging the establishment of other industrial enterprises in the city. A brief industrial history of the city is given, and there is an alphabetical list of the names of manufacturing companies with the names of the directors, and a list of products manufactured in Coventry. In addition, there is a section containing information regarding the city and some useful notes relating to taxation, tariffs and other matters to help manufacturers overseas who are considering the establishment of factories in Great Britain. A number of excellent illustrations of various works in Coventry are included.

"Franco" service vans equipped with neon signs and (right) one of the generating sets

The Electrical Industry in Czechoslovakia

In a recent issue of *Elektrotechniky Obzor* details are given of the development and progress of the electrical industry in Czechoslovakia. There are now 363 concerns in Czechoslovakia engaged in electrical engineering and employing an aggregate of 24,192 persons. Sixty-eight concerns are engaged in producing electricity meters, measuring instruments and other similar apparatus, while twenty-four works manufacture installation material. The production of electric lamps is one of the branches which has made rapid progress, there being now eleven such concerns. As for electric wires and cables, Czechoslovakia can now not only supply home requirements but is catering for the export trade. Forty concerns are constructing electric generators, motors and transformers, while twenty-three works are manufacturing primary and secondary batteries. The manufacture of l.p. material has also made rapid progress. Poland and the Eastern European countries are the best customers.

The South London Exhibition

Practically every electrical appliance available for use in the home is represented in a model all-electric flat which forms the principal exhibit on the stand of the County of London Electric Supply Co., Ltd., and its associated companies, at the sixth annual South London Exhibition now being held at the Crystal Palace. In addition to the flat, which comprises a lounge-hall, drawing room, dining room, bedroom, bathroom, kitchen and scullery, is a special room with seating accommodation for fifty persons where four cooking and two laundering demonstrations are given daily. Prominent in the front of the display stands a large clock tower round the base of which is a selection of Smith's domestic timekeepers, all testifying to a slogan above to the effect that "Electric Time is Greenwich Time." On one side of this clock tower are tables containing displays of the smaller apparatus, on the other being examples of electric cookers, wash-boilers, washing machines, refrigerators, vacuum cleaners, &c. Placards draw attention to the merits of the "Osira" street lighting units installed above the stand. "Ionlite" neon tubing round the façade and the word "Electricity" in lights high up above assist in rendering the stand one of the most attractive in the exhibition. The new "Goblin Ace" vacuum cleaner makes its first appearance on the stand of the British Vacuum Cleaner and Engineering Co., Ltd., whose twenty-four "Goblin Girls" give cabaret displays in the Concert Hall. Other electrical exhibitors include "Servis" Electric Washers, Ltd.; Fortiphone, Ltd.; Beatty Bros., Ltd.; Stokes Appliances, Ltd.; Tellus Super Vacuum Cleaner, Ltd.; Hoover, Ltd.; Buxton & Longley, Ltd.; Keating & Miskin; Harles; A. Olby & Son, Ltd.; W.N. Radio; Reliance Electrical Co., Ltd.; the Hurley Machine Co. (England), Ltd.; and Ideal Home Electrical Appliances, Ltd. The exhibition closes to-morrow (Saturday).

One of the largest and most attractive stands at the South London Exhibition, Crystal Palace, is that of the County of London Electric Supply Co., Ltd.

Advertisement Correction

Messrs. Drake & Gorham Wholesale, Ltd., ask us to correct an error in their advertisement which appeared on page 30 of our Advertisement Supplement of February 28th. The price of the washing machine is £6 16s. 6d., not £5 16s. 6d. as stated.

The Preston Electrical Exhibition

Considerable interest was taken in an electrical exhibition organised by the Preston Corporation Electricity Department, in co-operation with the local branch of the E.C.A., which was opened on Monday last by Sir John Brooke, vice-chairman of the Electricity Commission. A special feature was the application of electricity to agriculture. Most of the leading manufacturers had stands, and there was a large attendance at the opening ceremony. The Mayor (Councillor E. Ley) presided, and Sir John Brooke, in declaring the exhibition open, congratulated Preston on its progress in electrical development which, he said, was well in advance of the average for the country. It was not necessary in a district where domestic consumption was already 900 kWh per head annually to extol the advantages of electricity for domestic purposes. A comparison of the figures for last year with those for 1923 shows remarkable progress. Last year the sales totalled 135,250,000 kWh (against 4,333,333 kWh in 1923), and the number of consumers was 31,319 (against 3,147). There were no cookers or wash-boilers in use in 1923, but last year 10,000 cookers and 4,250 wash-boilers were on circuit. A general view of the exhibition appears on page 389.

Two Cinemas in One

Adjoining Oxford Circus Underground Station are now two cinemas, one on top of the other. The original Cinema House Theatre has been modernised and renamed Studio One, which will be used to present Continental films. Beneath this has been built another, Studio Two, where news and travel films will be shown, supplemented by up-to-the-minute news on a "Scinetape" installed by the Sign Construction Co., Ltd., directly under the screen. The air in both cinemas is kept pure and at a comfortable temperature by means of a plenum system of ventilation installed by Messrs. Heywood & Bryett. With the exception of the emergency lighting, the whole of the illumination in Studio Two comes from tubular lamps (Tubelight Sales, Ltd.) situated at intervals along the side walls, large pendant fittings (F. H. Pride) being employed in Studio One. The curtain control equipment was manufactured by Messrs. W. J. Furse & Co. (London), Ltd., while "Simplex" projectors, "Magnare" high-intensity lamps, and all the projection equipment were supplied by Messrs. J. Frank Brockliss, Ltd. Direct current for the projector arcs is provided by means of Hewittic mercury-arc rectifiers. Western Electric sound equipment is used. The electrical contractors for the building were Electrical Installations, Ltd., an exterior neon installation being carried out by the Major Equipment Co., Ltd. Pictures of the building appear on page 401.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price, March 11th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3⅝d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3⅝d.	—
a ,, Crystals .. .. per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£197	£5 inc.
Grade II... ... ... ,,	£136	£3 inc.
Grade III ... ... ,,	£71	£1 inc.
c Brass (rolled metal 2" to 12" basis)... per lb.	7¾d.	—
c ,, Tubes (solid drawn) ... ... ,,	9¾d. to 10d.	—
c ,, Wire, basis ... ... ,,	7¾d.	—
c Copper Tubes (solid-drawn) ... ,,	10¼d.	—
g ,, Bars (best selected) .. per ton	£68	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£41	10s. inc.
d ,, ,, Wire Rods ... ,,	£47	10s. inc.
d ,, ,, H.C. Wire ... per lb.	7⅞d.	⅛d. inc.
f Ebonite Rod ... ... ,,	1/6 to 2/- plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	8¼d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£18 15s.	5s. inc.
g Mercury ... ... per bot.	£12/7/6 to £12/15/-	2/6 to 3/6 inc.
e Mica (in original cases) small ... per lb.	6d. to 1/-	—
e ,, ,, medium ... ,,	5/- to 10/-	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11¾d.	—
p ,, ,, rolled strip & sheet ,,	11¼d.	—
p ,, ,, wire ... ... ,,	1/0½	½d. dec.
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	8¼d.	¼d. dec.
g Spelter ... ... per ton	£16 2s. 6d.	7s. 6d. inc
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£214 10s.	£7 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Social Events

The Wallasey and Birkenhead Electrical Trades Golfing Society began its third season on March 12th with a competition over the course of the Leasowe Golf Club. The competition took the form of a medal round and competitors were as usual divided into two sections as follows :—Class A, scratch to 18; class B, 19 and over. The first prize in Class A was the Kell's Challenge Cup and replica which was won last season by Mr. K. Marsden. The Marsden Challenge Cup and replica was the first award for Class B competitors. These prizes will be held for twelve months by the players returning the lowest net scores in their respective sections. There was also a special prize for competitors with handicaps of 22 and over.

On February 28th and 29th Bruce Peebles Concert Party and Orchestra presented "Sparks and Flashes," a revue produced by Mr. A. E. Crawley, at the Little Theatre, Edinburgh. The revue had a number of highly spectacular events, including a Hawaiian scene. Mr. J. L. Ferguson and José Young headed the large cast, and were ably assisted by the

Players in "Sparks and Flashes," the Bruce Peebles revue

Harmony Trio and the "Five Step Sisters." The stage settings and costumes gave a striking and colourful effect. The works orchestra was conducted by Mr. H. Woods, shop superintendent. There were large audiences on both evenings, and a fully attended matinée was given on Saturday afternoon.

A happy evening was spent by the staff of L.E.S. Distributors, Ltd., at the dance held last week. It was originally to have taken place in February, but was postponed owing to the national mourning. The organisers, the Sports & Social Club, were rewarded for their efforts by an even larger attendance than usual.

On Tuesday and Wednesday the Lewcos Dramatic Society (London Electric Wire Co. and Smiths, Ltd.) staged "Old Man Minick," a play which achieves originality in its treatment of the father-in-law problem and in the amount of domestic dissension which is crowded into less than two and a half hours. The various character studies were portrayed in such a delightful fashion that interest was maintained until the end. Mr. S. Graefe in the title role was excellent, and the leading parts were skilfully played by Miss G. Woodcock and Mr. G. Sinclair. The next production by the company will be on November 10th.

For Sale

Kendal Electricity Department has for disposal a steam engine direct coupled to a 120-kW d.c. generator, and battery-charging plant.

(See our classified advertisements.)

Hirst Hall

Considerable extensions during the past year have been made to the group of factories of the General Electric Co., Ltd., at North Wembley and the large number of additional employés now engaged there has accentuated the need for adequate canteen accommodation. For this purpose a new building, named Hirst Hall, has been erected. The canteen is 150 ft. long and 50 ft. wide and can accommodate over 1,000 people. Though primarily used as a canteen, this hall also serves as a venue for club and social activities. On March 5th Lord Hirst inspected the new hall at the dinner hour, when he made a short speech formally to dedicate the hall for the use and enjoyment of the workpeople. He was accompanied by Mr. C. Wilson, director and manager of the Osram Works. Mr. Chelioti, works manager, Mr. W. W. Warren and other works officials.

A Ruston & Hornsby Development

Messrs. Ruston & Hornsby, Ltd., announce the completion of a licence agreement with the Hercules Motors Corporation of Canton, Ohio, U.S.A. Under the new arrangement Ruston & Hornsby, Ltd., will build in England Hercules light-weight, high-speed, compression-ignition Diesel engines. The British product will be known as the Ruston (Hercules type) engine.

New Catalogues and Lists

Renold & Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester.—A data sheet dealing with chain drives.

International Combustion, Ltd., Aldwych House, London, W.C.2.—A brochure dealing with "Cantieny" super-pressure boilers.

Piggott Electrical Co., Ltd., Salisbury Square House, London, E.C.4.—A price list of cables.

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—A folder showing examples of street-lighting installations with "Simplex" fittings.

Marconiphone Co., Ltd., 210/212, Tottenham Court Road, London, W.1.—A complete catalogue of 1936 radio receivers.

Phosphor Bronze Co., Ltd., Sumner Street, London, S.E.1.—A leaflet describing Millard metal, an anti-corrosive bronze alloy.

Cooper-Stewart Engineering Co., Ltd., 136, Long Acre, London, W.C.2.—A folder illustrating, with specifications, the Stewart Warner refrigerators.

Mickelwright, Ltd., Alperton, Wembley.—Details of a new starter circuit-breaker for direct-on-line starting of a.c. motors.

Ray Engineering Co., Ltd., 53, Queen's Square, Bristol, 1.—Particulars of emergency lighting equipment in leaflet form.

R. F. Winder, Belgrave Electrical Works, Leeds.—A catalogue of new and second-hand electrical material in stock.

Elexcel, Ltd., Victor Works, Broad Green, Liverpool, 14.—A booklet describing and illustrating "Xcel" water-heating equipment.

Gent & Co., Ltd., Faraday Works, Leicester.—A booklet dealing with the "Tangent" staff locator.

Davis & Timmins, Ltd., Brook Road, Wood Green, London, N.22.—A price-list of terminals, cable sockets, &c.

Bankruptcy Proceedings

J. S. W. Bartley, company director, 6, Sydney Place, S.W.—The public examination of this debtor was held on March 4th at the London Bankruptcy Court, the accounts showing total liabilities of £14,113 (ranking £10,613) and assets of £2,500. The debtor stated that in October, 1931, he promoted J. B. Electrical Co., Ltd., to deal wholesale in electrical fittings. He subscribed for 1,970 shares of 1s. each, and acted as a director until the company went into voluntary liquidation in September, 1935. In June, 1932, he promoted St. James's Electrical Co., Ltd., to deal retail in electrical fittings. He subscribed for 1,780 1s. shares and acted as director of that company until September, 1935, when it also went into voluntary liquidation. With money borrowed from friends and relatives he had advanced in all £7,500 to those two companies; he also guaranteed advances and trade debts on their behalf to the extent of about £3,000. The debtor attributed his insolvency to the failure of the two companies. The examination was concluded.

C. R. Miskin (trading as Miskin & Rice), electrical contractor, Bush House, Aldwych, W.C., and late of 31, Windmill Street, W.—This debtor petitioned the London Bankruptcy Court and was adjudged bankrupt on February 22nd. The statutory first meeting of creditors was held on March 4th, when accounts were submitted showing liabilities of £1,139 against assets of £89. The failure was attributed to lack of capital, pressure by creditors, and inadequate profits on contracts. The case was left in the hands of the Official Receiver to be wound up in bankruptcy.

H. Vernon, Palatine Road, Northenden, Manchester, electrical contractor.—The public examination was held recently at Stockport, when it was stated that the liabilities amounted to £521, with a deficiency of £311. The debtor stated that in July, 1932, he agreed to purchase for £800 an electrician's business, of which he had previously acted as manager. He borrowed £100 from a friend in order to pay the deposit, and the balance of £700 was payable by monthly instalments. At first the business was fairly successful and he was able to pay off £200. Subsequently the business began to decline and the vendor agreed to forgo the balance of the purchase price outstanding. In 1935 the debtor transferred the business to new premises, and for a time the turnover increased, but towards the end of the year it dropped. During 1935 he had had to contend with three electrical contractors who opened in opposition, five wireless dealers, and three hardware shops. The examination was adjourned for closing.

R. Field, electrical engineer, 61, Drewton Street and 156, Westgate, Bradford.—Public examination March 24th at the County Court, Manor Row, Bradford.

F. Pyle (F. E. Pyle), wireless engineer, Station Road, Okehampton.—Public examination March 27th at the Western Law Courts, Plymouth.

F. Stead, wireless dealer, 1, Manchester Square, Otley.—Trustee, Mr. H. C. Bowling, 24, Bond Street, Leeds, Official Receiver, released February 20th.

R. Mason, radio and electrical engineer, Crown Square, Kirbymoorside. First and final dividend of 6s. 10d. in the £, payable at 80, High Street, Stockton-on-Tees.

A. E. Poole and **H. Marsters** (Poole's), electrical engineers, 33, Union Street, Wednesbury.—First dividend of 10s. in the £, payable March 16th at Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

Company Liquidations

Torque Transformer Syndicate, Ltd.—Winding up voluntarily. Liquidator, Mr. A. G. Howard, 7, Great Winchester Street, E.C.

Southport Northern Wireless Supplies, Ltd.—Winding up voluntarily. Liquidator, Mr. W. E. Hopkins, 39, Fishergate, Preston.

Thermo-Electric Engineering Co. (Whitehall), Ltd.—Winding up voluntarily. Liquidator, Mr. F. H. Taylor, 188, Mitcham Road, S.W.17.

Herd & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. G. F. Robinson.

Private Arrangement

T. S. McDowell and **Rachel T. McDowell,** Peacehaven, Sussex, trading as T. & R. McDowell, radio and electrical dealers.—A meeting of creditors was held on March 4th at the offices of Mr. A. E. Orbell, 6/7, Old Steine, Brighton. The statement of affairs showed liabilities of £320, all due to the trade. After allowing £20 for preferential claims the net assets were £208, leaving a deficiency of £112. It was decided that the matter should be dealt with under a deed of assignment to Mr. Orbell as trustee, with a committee.

Electricity Supply

Lighting, Domestic, Power

Australia.—CO-ORDINATION IN NEW SOUTH WALES.—Mr Spooner, the New South Wales Minister for Local Government, recently explained to a conference of North Coast local authorities the Government's proposals for extending and cheapening the electricity supply. The proposals, he said, included the creation of a Greater County Council of nine members representing shires and municipalities in the coastal district between the Macleay and Tweed rivers to exercise all the powers of the constituent councils with regard to the supply of electricity. It was hoped to give legislative effect to the scheme on June 30th next. The policy of the State Government, he remarked, was to encourage electrical development in those parts where conditions were suitable, particularly in the North Coast area; to extend the supply of electricity to villages and rural districts not yet served; and to cheapen the supply in towns and districts already served. The proposed Greater County Council would take over the existing contracts and administer the whole of the electricity undertakings of the Clarence River County Council and other councils within the district which were now supplying direct to consumers.

IMPROVING MELBOURNE'S SUPPLY.—The City Council is to spend £219,770 on its electricity undertaking, states the *Australasian Electrical Times*.

PERTH PROFIT.—During the year ended September 30th last the City of Perth electricity and gas undertaking, of which Mr. F. C. Edmondson is general manager and Mr. H. Middleton electrical engineer, sold 50.6 million kWh, representing an increase of 11.6 per cent. compared with the previous year. The working profit from the electricity undertaking was £83,401, and from the gas section £37,743, the joint net profit being £79,077.

Banff.—STREET-LIGHTING.—After hearing representatives of the Grampian Electricity Supply Co. and the Banff and Macduff Gas Co. with regard to the lighting of the streets, the Town Council has decided to obtain estimates for comparison.

Barrow-in-Furness.—SUPPLY EXTENSIONS.—At a cost of £1,750, the Electricity Committee is to give a supply to the corn mills of Messrs. Walmsley and Smith, who are electrifying their works under the direction of Messrs. H. Simon. Mains are also to be extended, at a cost of £450, to enable an a.c. supply to be provided at the new Roxy Cinema which is being erected in Abbey Road.

Blackpool.—AN ILLUMINATIONS DEPARTMENT.—The Corporation has confirmed a recommendation to have a separate Illuminations Department, with Mr. F. W. Field as director. The intention is to relieve the Electricity Department of the task of carrying out the illuminations.

Bradford.—NEW PLANT.—Cables are to be replaced and high-voltage switchgear installed at the Electricity Department's Tong Street sub-station at a cost of £3,363.

Cannock.—FRINGE ORDER.—The Electricity Committee is seeking a Fringe Order to supply premises in Penkridge.

Cardiff.—NEW SUB-STATION.—A new sub-station, built to supply the feeders at the new steelworks of the Guest Keen Baldwins Iron & Steel Co., Ltd., East Moors, Cardiff, has been officially inaugurated by the Electricity Committee. The equipment was supplied by the General Electric Co., Ltd., and consists of the latest type of metal-clad compound type switchgear. The switchboard connects the grid to the Corporation's system through two 15,000-kVA transformers. High-voltage d.c. testing equipment is also installed, and the building is protected by the "Alfite" CO_2 fire extinguishing system. The total cost was £39,500.

Chichester.—SPECIAL TARIFFS.—The City Council has decided to supply electricity to the West Sussex County Council offices on a two-part tariff basis at the rate of 15 per cent. of the rateable value, plus a "unit" charge of 0.6d. The Council has also fixed a special tariff of 1d. per kWh for the lighting of cowsheds and for horticultural purposes.

China.—ELECTRICITY SUPPLY DEVELOPMENTS.—The Chinese National Economic Council is reported by the *Far Eastern Review* to have sanctioned the raising of a loan for the construction of a new hydro-electric power station in the Province of Kiangsi. It is also reported that the Siemens-Schuckert Works Co. has secured a contract for the construction and equipment of a new steam-operated power station for Canton and the order for a 15,000-kW turbo-generator for Peiping (Pekin).

Derby.—FINANCING DEVELOPMENT.—Application is to be made by the Electricity Department for permission to borrow £157,000 for sub-stations, mains and services, meters, switchgear and cookers.

Dover.—REDUCED CHARGES.—As from April 1st, the Electricity Department is reducing its charges as follows (existing rates in parentheses): Lighting, ordinary meters, 4¾d. (5d.) per kWh, less ½d. per kWh cash discount; annual contracts, secondary rate, 3¾d. (4d.) per kWh, less ½d. cash discount; prepayment meter lighting, cash rebate increased from 2½d. to 3d. per kWh; commercial power, initial rate of 3d. per kWh to be eliminated; heating, cooking and domestic power, ¾d. (1d.) per kWh; public lighting, 2½d. (2¾d.) per kWh. The total cost of the reductions is estimated at £4,920 per annum.

Eccles.—SUB-STATION.—The Mount Street sub-station is to be extended by the Electricity Committee at a cost of £1,941, and a new sub-station is to be provided, at a cost of £4,378, to improve the supply in the Worsley and Winron areas.

ELECTRICITY PREFERRED.—Further conversion of the street lamps from gas to electric is to be undertaken by the Electricity Committee at a cost of £1,000.

Elie and Earlsferry (Fifeshire).—STREET LIGHTING.—Estimates for street lighting by electricity and gas are to be obtained by the Town Council.

Fort William.—CALEDONIAN SCHEME COMMENDED.—At its recent meeting the Town Council decided to give its wholehearted support to the Caledonian Power Bill which is at present before Parliament. It was felt that the scheme would prove of considerable advantage to Lochaber and the county generally.

Friern Barnet.—DISCHARGE LIGHTING.—The Urban District Council is to erect twenty-nine 250-W electric-discharge lamps housed in special lanterns along the North Circular Road.

Harrow.—ELECTRICITY FOR COUNCIL HOUSES.—The provision of electric lighting in about 100 Council houses in Little Stanmore and 32 in Great Stanmore has been approved by the Urban District Council. The cost is estimated at about £2,000, and the Housing Committee is to obtain tenders.

Heighington (Co. Durham).—STREET LIGHTING.—The Parish Council has received estimates from the North-Eastern Electric Supply Co., Ltd., and the Darlington Corporation Gas Department for the public lighting of the village. A meeting of the electors is to be held to decide which offer shall be accepted.

Houghton-le-Spring.—ELECTRICITY CHOSEN IN THE INTERESTS OF TENANTS.—The Urban District Council has received a complaint from the Houghton-le-Spring District Gas Co. that the Council's decision to install electricity in Council houses would have a serious effect upon the company, and that it had not had the opportunity of tendering for gas lighting. The Council agreed to inform the company that it had given the matter careful consideration, and decided in favour of electricity in the interests of the tenants.

India.—PUNJAB ELECTRICAL PROGRESS.—The annual report on the administration of the Indian Electricity Act in the Punjab during the past year states that, excluding the Uhl River hydro-electric project, the total installed generating capacity of licensed undertakings rose from 9,765 to 21,996 kW, while the amount of electricity sold by such undertakings during the year was 25,874,000 kWh. The total generating capacity of the Uhl River hydro-electric project remained at 48,000 kW, but the amount of electricity sold increased to 8,494,000 kWh. During the year the Electricity Advisory Board held an inquiry regarding the maximum rates in Lahore, and certain reductions were recommended which were accepted by the Government, with the result that there was a considerable increase in the load connected, states our Bombay correspondent.

HYDRO-ELECTRIC SCHEME.—The United Provinces Legislative Council has approved revised estimates for the hydro-electric scheme as amended by the Grid Inquiry Committee of 1935, and has decided that the scheme should be completed by 1937-38. The revised estimates amount to Rs.337 lakhs, and the committee of experts has stated that the scheme is technically and economically sound and should produce the results anticipated. The Government accepted the amendment moved by a private member of the Council that progress in the execution of the scheme should be made with due regard to the financial results so far obtained and the effect of the grid scheme on general irrigation. As a measure of safety, it is proposed to add a contingent provision of ten per cent. to the works estimate of the Mohammadpur power station, the installation of the third turbo-generating set at Chandausi and the works estimate of the transmission line to be constructed in 1937 and thereafter. All industrial consumers requiring a high-voltage supply will be supplied direct by the Department, and the areas of licences will be confined as far as practicable within municipal limits and urban areas.

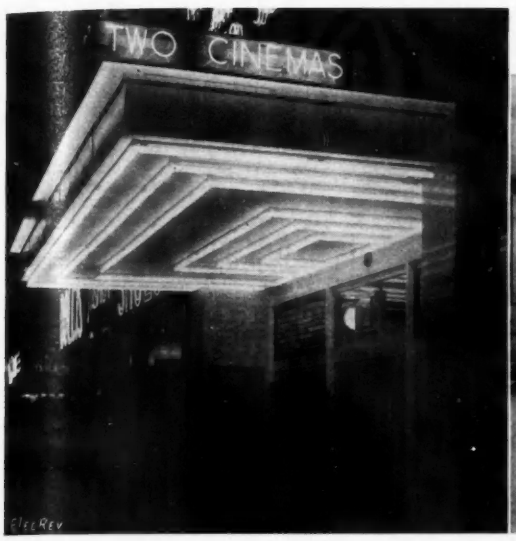
Irish Free State.—LOCAL AUTHORITIES IMPEDE THE ELECTRICITY BOARD.—As a result of a number of Councils refusing to allow their tenants to use electricity the Ministry of Home Affairs has sent a circular letter to all urban district and borough councils. It is pointed out that such houses are built under special statutory powers for a particular purpose which does not include the production of revenue for the gas undertaking, and it is, therefore, doubtful whether the clause in the letting agreement requiring tenants to use gas can be legally enforced. It also seems unreasonable to refuse to allow a tenant to use electricity instead of gas when the new service is introduced at no cost to the ratepayers. The Ministry further states that the Electricity Board is a public body carrying out a public service and is also a considerable ratepayer, and, therefore, in the general interest, it is desirable that it should be facilitated rather than impeded in its operation by local authorities.

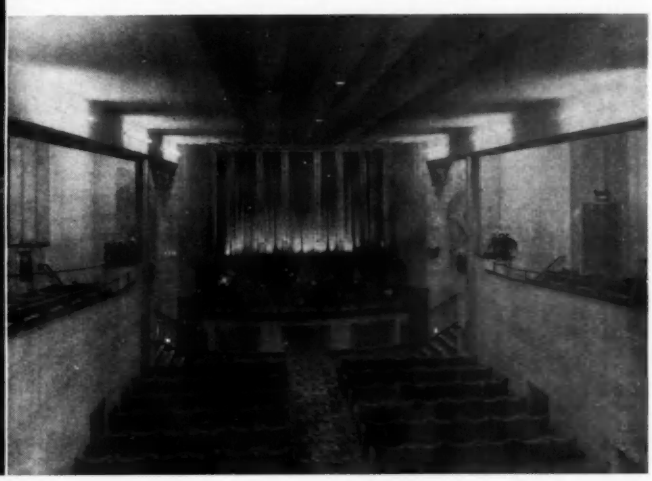
Isle of Axholme.—OVERHEAD LINE.—The Rural District Council has consented to the North Lincolnshire and Howdenshire Electricity Co., Ltd., erecting an overhead line through the parish of Keadby.

Kettering.—CABLE LAYING.—The work of laying a new h.v. cable from Kettering to Market Harborough *via* Rushton and Desborough has been put in hand. The cable will provide an alternative to the present supply *via* Rothwell, Desborough and Braybrooke.

Liverpool.—OPPOSITION TO POWER STATION EXTENSIONS.—There was opposition at a recent City Council meeting to the proposal to extend the Clarence Dock power station by plant and buildings costing £767,580. Alderman Burton Ellis said this was not an opportune time to add to their commitments. Too much capital (£11,000,000) was sunk in the elec-

tricity undertaking, and he did not think that they received a fair return. Nor could it be said they were the cheapest producers of electricity. The return was about £70,000 a year, and the reserve only £400,000. Alderman F. C. Wilson, chairman of the Electricity Committee, replied that Liverpool was generating electricity at a lower price than almost any other city in the country. The Central Electricity Board and the Electricity Commissioners desired the station to be doubled





The entrance to Cinema House, Oxford Circus, and (right) the interior of "Studio Two" (See "Two Cinemas in One," page 398)

in size immediately. Capital expenditure and sinking fund were all guaranteed by the Board. The expenditure was approved.

London.—DEPTFORD.—The Council is seeking permission to borrow £1,250 to pay for electrical installations in houses on the Council's Brockley estate.

Luton.—SUPPLY TO HOUGHTON REGIS.—A supply of electricity is to be given to Houghton Regis by means of an overhead line.

Manchester.—MEETING THE INCREASED LOAD.—A report on the growth of the electrical load in the West Denton and East Droylsden districts has been considered by the City Council, which proposes, in the former area, to replace a 3,000-kVA transformer by one of 10,000 kVA, and later to substitute a second 10,000-kVA transformer for one of 4,000 kVA. At East Droylsden, a 10,000-kVA transformer will replace one of 3,000 kVA, and later a second 10,000-kVA transformer will be installed. Modifications to the existing 33- and 6.6-kV switchgear will also be required. The cost of the work is estimated at £11,500.

TRACTION SUPPLY CHARGES.—Representatives of the Electricity and Transport Committees have been in conference on the subject of charges for electricity for traction purposes. A modified scale will operate as from April 1st next.

Morley.—THREE-PHASE POWER SUPPLY.—A £35,000 scheme for changing over the power supply from single-phase to three-phase has been approved by the Town Council.

Newcastleton (Roxburghshire).—CANVASS.—The inhabitants are being canvassed on the question of a supply of electricity being made available. The supply authority is the Dumfries County Council.

Northallerton.—OVERHEAD LINES.—No opposition is being offered by the Rural District Council to the North-Eastern Electric Supply Co., Ltd., erecting overhead lines at East Cowton and Great Smeaton.

Northern Ireland.—MORE DISCHARGE LIGHTING.—A trial system of electric-discharge lighting in Malone Road, Belfast, was so convincing that this type of lighting is being installed in three other thoroughfares.

Norway.—POWER COMPANY'S DEFICIT.—Our Scandinavian correspondent reports that the large Norwegian water-power company Hovangfallene has published accounts for 1935 revealing a loss of nearly 100,000 Kroner. The Naco combine is reported to have offered £322,250 for the Hovangfallene plant, and the sale is being negotiated. The plant has a capacity of 26,000 h.p., but this can be expanded to 50,000 h.p.

Ormskirk.—ELECTRICITY IN COUNCIL HOUSES.—The Urban District Council is taking steps to secure the installation of electricity in its houses at Red Cat Lane, Burscough.

Perth.—NEW FEEDER CABLES.—Application is to be made by the Town Council for permission to borrow £3,000 for laying two feeder cables from the power station to the centre of the city.

Plymouth.—MAINS AND SUB-STATIONS.—The Electricity Committee is to erect sub-stations at a cost of £9,810, extend mains at a cost of £9,769, and provide transformers, switchgear, &c., at a cost of £22,724 to improve the supply in various districts.

METERS.—Sanction to borrow £16,000 for meters is being sought by the Electricity Committee.

Pontardawe.—REDUCTION IN CHARGES.—The lighting tariff is to be reduced from 6d. to 5d. per kWh and the power rate from 3d. to 1½d. In addition, a 20 per cent. reduction will be made in the standing charge of the all-in tariff, while the running charge will be lowered by ¼d. per kWh.

Portsmouth.—ASSISTED WIRING.—Sanction to borrow £50,000 for assisted wiring is being sought by the Electricity Committee.

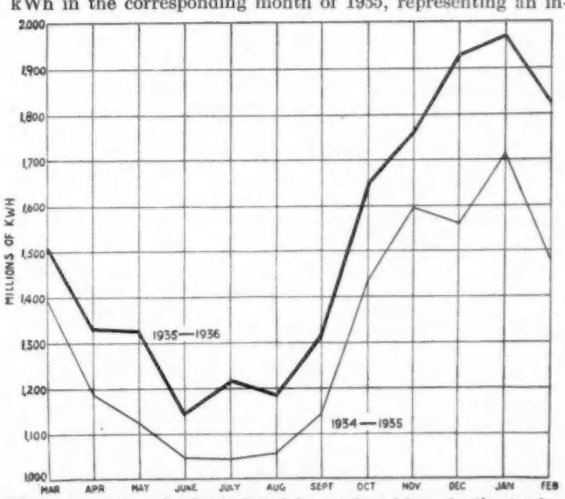
Siberia.—NEW HYDRO-ELECTRIC POWER STATION.—The *Monthly Review* of the U.S.S.R. Trade Delegation in Great Britain reports that a new hydro-electric power station, known as the Baikal, five miles to the north of Irkutsk, Eastern Siberia, will have a capacity of 525,000 kW, and approximately 75 per cent. of the output will be utilised by various works which are being established in the area.

Southport.—ILLUMINATIONS SCHEME.—Consideration has been given by the Publicity and Attractions Committee of the Council to a scheme of illuminations which is estimated to cost approximately £3,000.

Stoke-on-Trent.—CONFERENCE OF LOCAL AUTHORITIES.—On March 5th a conference of representatives of authorised undertakings in the North West Midlands Electricity District was held at the Stoke-on-Trent Town Hall to deal with the standardisation of methods of charge for the supply of electricity in the respective areas. The chairman of the conference, Alderman Sampson Walker, who is chairman of the Finance and General Purposes Committee of the North West Midlands J.E.A., outlined the proposals, and it was unanimously agreed that such standardisation was desirable. It was decided to

Generation of Electricity

THE official returns of the Electricity Commissioners show that 1,824 million kWh of electricity was generated by authorised undertakings in Great Britain during February as compared with the revised figure of 1,478 million kWh in the corresponding month of 1935, representing an increase of 346 million kWh, or 23.4 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was 25 as against 24 last year.



The output of authorised electricity undertakings in the twelve months to the end of February last, with comparative curve for 1934-35

During the first two months of 1936 up to the end of February the total amount of electricity generated by authorised undertakings was 3,794 million kWh as compared with the revised figure of 3,191 million kWh for the corresponding period of 1935, representing an increase of 603 million kWh, or 18.9 per cent.

form a Technical Sub-Committee consisting of the engineers of the different local authorities to investigate the problem and report to the conference.

Tain (Ross-shire).—PURCHASE OF ELECTRICITY UNDERTAKING.—The Town Council has under consideration a proposal by the Scottish Power Co., Ltd., to purchase the Council's electricity undertaking.

United States.—ANALYSIS OF 1935 GENERATION FIGURES.—Although the generating capacity of hydro-electric plant in the United States was reduced from 9,021,700 to 8,958,000 kW in 1935, the plant in commission was more fully utilised, the net output increasing by 16.9 per cent. to 36,377 million kWh. On the other hand, while steam and internal-combustion engine plant was augmented by 311,000 kW, bringing the total up to 24,177,400 kW, the energy generated advanced by only 4 per cent. to 55,951 million kWh. Thus the percentage of energy generated by water-power stations increased from 37 to 39.4. These statistics, published in the *Bulletin* of the Edison Electric Institute, apply to the whole electric light and power industry of the country. It is further shown that, including purchased energy and allowing for that used in the electric railway and other departments, there was a total of 93,420 million kWh available for distribution, representing an increase of 9.2 per cent. compared with the previous year. Energy lost in transmission, distribution, &c., amounted to 15,866 million kWh (7.3 per cent. more than in 1934), the revenue from ultimate consumers being $1,921 millions, an increase of 4.6 per cent. Domestic consumers took 13,978 million kWh (9.2 per cent. increase), the average annual consumption in this class improving from 631 to 673 kWh. The average number of domestic consumers for the year was 20,779,000 (+2.5 per cent.). They contributed a total revenue of $703 millions (+3.7 per cent.), which was higher than from any other class of consumer although bulk supplies of light and power (commercial) accounted for nearly three times as much energy. Additional electric operation of railways is revealed by an increase of 18.8 per cent. to 835 million kWh in the energy used on electrified steam lines.

TEN-YEAR ELECTRIFICATION PLAN.—The Norris Rural Electrification Bill, which lays down a ten-year programme for electrification throughout America, was passed without record in the Senate last week and sent to the House of Representatives. The Bill authorises the granting of loans by the States or local authorities to the amount of $50,000,000 a year in the first two years and $40,000,000 a year for the next eight years, making $420,000,000 in all. Farmers will be encouraged to install electrical equipment in houses and barns and will be allowed to repay loans by instalments.—*Reuter*.

Wallsend-on-Tyne.—NEW CABLE.—Plans submitted by the North-Eastern Electric Supply Co., Ltd., for laying a low-voltage underground distribution cable in Station Road, north of Hawthorn Avenue, have been approved by the Town Council.

Watford.—ELECTRIC COOKING INSTRUCTION.—A recommendation has been made by the Electricity Committee that electric cookers shall be let out on hire at one shilling a quarter for the purpose of instruction in electric cookery at recognised educational establishments.

Wolverhampton.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to the following estates:—Three Tuns, Oxley (£881); Nursery (£324); and Low Hill (£287).

Traction

Blackburn.—TRAMWAY IMPROVEMENTS.—The Tramway Committee contemplates spending £10,200 on renewing the permanent way, principally in the Wilpshire section. It is also intended to modernise motors and brakes (£8,180) so as to enable the trams to travel at a higher speed.

Burma.—TROLLEY-BUSES.—Rangoon is one of the latest cities to convert its tramways to trolley-bus operation, states *Indian Engineering*. Our contemporary suggests that, with the increasing traffic presenting a problem in many other Indian cities, the local authorities might give the question of adopting trolley-buses serious consideration.

London.—NEW PARK ROYAL STATION.—The booking hall of the new Park Royal station on the Piccadilly line of the London Passenger Transport Board was opened last Sunday. The station is being rebuilt, and when completed a broad stairway will lead to the platforms from the circular ticket hall. A new entrance will be provided through a shopping arcade, and special arrangements will be made for passengers alighting from buses.

TRAMWAY STRIKE.—On Tuesday more than a thousand tramway employés of the London Passenger Transport Board took part in a strike, complaining that despite repeated requests to the Board the position whereby time lost through traffic delays curtails their meal times had not been remedied. The strikers, however, decided to return to work on Wednesday on the understanding that their grievances would be considered.

Russia.—BETTER TRANSPORT FACILITIES FOR MOSCOW.—According to a *Reuter* message from Moscow, the city is to have 250 trolley-buses, which is five times the number at present in operation. More than twenty miles of new tramway track is to be laid.

Surrey.—TRAFFIC CONTROL BY INVISIBLE RAYS.—The Minister of Transport has been invited to inaugurate an experiment for controlling both pedestrian and vehicular traffic at St. Helier Avenue, Surrey, by invisible rays. The apparatus has been installed at the request of the Surrey County Council.

Communications

British Malaya.—TELEPHONE SERVICE WITH BRITAIN.—Negotiations are proceeding for the establishment of a telephone service between Great Britain and British Malaya.

European Broadcasting.—SHORT-WAVE CONFERENCE.—The International Broadcasting Union has been holding its winter meeting in Paris during the past week, under the presidency of M. Maurice Rambert, Administrateur-Délégué of the Swiss Broadcasting organisation. Delegates were present from twenty-nine European national broadcasting organisations and from seven organisations overseas. At the opening session the president of the Union said that during 1935 the number of licensed listeners in Europe (including Russia) had risen from approximately 23,560,000 to 27,650,000. The Union examined, among other questions, the functioning of the Lucerne Plan under the severe winter conditions. It reached the conclusion that a further improvement in the situation had been obtained through the stricter application of the plan by a number of broadcasting organisations. The Technical Commission has been asked to re-examine the difficult situation existing in the over-crowded long-wave band. Members were urged to avail themselves of the technical means prescribed by the Union for the control of modulation. Attention was also given to the interaction interference generally termed the "Luxemburg effect." With regard to the stability of the frequencies of transmitting stations, it was noted that remarkable progress had been made in the European zone. The next meeting of the Union, including the annual general assembly, will be held at Lausanne-Ouchy (Switzerland) between June 22nd and July 1st next.

Great Britain.—TELEPHONE RATES FURTHER REDUCED.—In the House of Commons on March 9th Mr. Viant asked the Postmaster-General whether he was now in a position to modify the telephone trunk rates. Major Tryon said that construction work which was put in hand following the success which attended the reduction of trunk rates in October, 1934, had progressed satisfactorily, and he was, therefore, happy to announce that, from May 1st next, the maximum charge for a three-minute trunk call between any two places on the mainland, from 5 a.m. until 7 p.m., would be 2s. 6d., and 1s. at other times. This would afford reductions in rates during both the morning and afternoon periods between all places over 200 miles apart, and, in addition, he proposed to reduce the rates during the morning period for all distances from 35 to 200 miles. Thus the charges for a three-minute morning call between London and Birmingham would be reduced from 2s. 6d. to 2s., between London and Manchester from 3s. to 2s. 6d., and between London and Edinburgh, Glasgow or Aberdeen from 4s. to 2s. 6d. Equivalent reductions would apply to calls between the mainland and Northern Ireland, the Channel Islands, the Isle of Man and the islands of Mull, Iona, Islay and Lewis, the reduced charges being still subject to the addition of the existing cable charges, which, he regretted, it was impracticable to modify at present owing to the plant position. The reductions would not apply to calls from the United Kingdom to the Irish Free State. In 1934 the system of charging was simplified by abolishing local differences, so that the same rate was chargeable from all exchanges within a town area to any single destination beyond 75 miles. From May 1st this arrangement would be extended to include all calls beyond 50 miles. Technical progress was gradually extending the distance up to which subscribers on an automatic exchange could obtain their own connections by dialing, the charge being recorded by automatic apparatus. To facilitate that process he proposed to make some minor adjustments in the charges for local calls up to 15 miles chargeable distance which would give uniform rates throughout the day and evening periods and, for the most part, cheapen the calls between 10 and 15 miles. Small increases of charge would be necessary in some instances, but, on balance, the public would gain considerably from the adjustments. His proposals as a whole involved a sacrifice of revenue which, on the present volume of traffic, would amount to £600,000 in the first full year, but he felt sure that they would be justified, as were the reductions of 1934, by the increased use that would be made of the telephone service, and that the sacrifice of revenue would be reduced progressively as the service developed.

TELEPHONE SERVICE TO KENYA.—A direct radio-telephone service between Great Britain and British East Africa was inaugurated last Friday, when messages were exchanged between London and Nairobi, the speakers being the Colonial Secretary (Mr. J. H. Thomas), the Postmaster-General (Major Tryon), Mr. J. C. Denison-Pender (Cable & Wireless, Ltd.), the Governor of Kenya (Brig.-Gen. Sir Joseph Byrne), and the Postmaster-General of Kenya (Mr. T. FitzGerald).

Irish Free State.—RADIO ESTIMATES.—The estimates for the supply services for the ensuing financial year (1936-37) were issued on March 3rd. The estimate for broadcasting is £57,700, as compared with £40,838 for the year now ending. Provision is being made for a sum of £14,000 in respect of plant and apparatus for the high-power broadcasting station at Athlone.

Isle of Man.—RADIO STATION.—It is reported that a syndicate has been formed to establish a broadcasting station on the island. It is willing to pay £20,000 annually to the Manx Government as a licence fee, and in order to facilitate matters Mr. J. H. L. Cowin has given notice that he will move, at the next Tynwald, that the island shall not enter into any agreement with the B.B.C.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberystwyth.—March 30th. Electricity Department. Underground cables, feeder and distribution pillars and disconnecting boxes. (See this issue.)

Australia.—HOBART.—April 20th. Municipal Tramways. One 11,000-V three-phase, 750-kW, a.c. to d.c. rotary convertor or rectifier. (T.Y. 10412.)*

Barnoldswick.—March 16th. Electricity Department. Cables for one year. (March 6th.)

Beckenham.—March 23rd. Borough Council. Meters and cookers for one year. (See this issue.)

Birmingham.—March 25th. Electric Supply Department. A.c. and d.c. distribution boards. (See this issue.)

Brighton.—March 23rd. Borough Council. Electric lighting in one block at the Municipal Hospital. W. N. C. Clinch, engineer and manager, "Electric House," Castle Square (deposit £1 1s.).

Bristol.—March 18th. Electricity Department. Fifteen e.h.p. transformer pillars. (March 6th.)

Bromley.—March 23rd. Electricity Department. Cables. (See this issue.)

Clitheroe.—March 14th. Electricity Department. Cables and meters for one year. (February 28th.)

March 16th. H.d. copper conductor. (March 6th.)

March 23rd. Wood poles. (March 6th.)

Dartford.—March 23rd. Cable. (See this issue.)

Dumfries.—March 23rd. County Council. Electrical wiring, &c., at Academy. J. Robson, county clerk, County Buildings (deposit £1 1s.).

March 20th. Town Council. Electric lighting at 110 houses on the Nithside estate. R. S. Osborne, borough surveyor.

March 17th. Dumfries and Galloway Joint Sanatorium Board. Electrical and heating works at extensions of the Lochmaben Sanatorium. J. Robson, clerk to the Board, County Buildings.

Dundee.—March 19th. Harbour Trustees. Two 3-ton (alternatively one 3-ton and one 5-ton) electric travelling cranes. General manager and engineer, Harbour Chambers.

East Grinstead.—March 18th. U.D.C. Meters for one year. (March 6th.)

Edinburgh.—March 19th. Corporation. Electric lighting and power in Royston primary school. Engineer's Office, Dewar Place (deposit £1 1s.).

Glasgow.—March 21st. Public Health Department. Supplies, including electrical fittings, at hospitals for one year. Superintendent of Stores, 25, Montrose Street.

Great Western Railway.—March 20th. Stores for one year. (March 6th.)

Great Yarmouth.—March 26th. Electricity Supply Department. Materials for one year. (March 6th.)

Guildford.—March 20th. Electricity Department. Cables for one year. (See this issue.)

Hull.—Telephone Committee. Telephone cables. Automatic table telephones. (March 6th.)

India.—SIMLA.—April 21st. Stores Department. Wall plugs, ceiling roses, &c., required during the period from July 1st, 1936, to June 30th, 1937. (T.Y. 10402.)*

Keith.—March 16th. Town Council. Converting the street lighting system to electricity, including supply of fittings and service cables. G. S. Stewart, borough surveyor.

Kirkcaldy.—March 24th. Corporation. Electric lighting of 276 houses. G. B. Deas and T. Bertram, Central Chambers (deposit £1).

Lancaster.—Electricity Department. Cables. (March 6th.)

Langho (near Blackburn).—March 18th. Committee of Managers, Brockhall Mental Institution. Twelve months' supply of electric lamps. Clerk and steward.

Leeds.—March 18th. Housing Committee. Electrical work at estate, including 1,763 dwellings in York and Selby Road, 664 at Crossgates, 140 at Halton, and 310 at Ivy House and East End Park. R. A. H. Livett, housing director, 26, Great George Street (deposit £2 2s.).

March 17th. Education Committee. Various works, including electrical, in various buildings during twelve months ending March 31st, 1937. G. Guest, director of education, Education Offices.

London.—LONDON & HOME COUNTIES J.E.A.—April 6th. Annual supply of general electrical accessories. (See this issue.)

METROPOLITAN WATER BOARD.—April 17th. Two high-compression heavy fuel oil engines with centrifugal pumps and electrical generators, three electrically driven bore-hole pumps, switchboard, &c., at the Shortlands pumping station, Kent. Chief engineer, Room 235, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the Accountant to the Board).

POPLAR.—March 18th. Borough Council. Switchgear, transformers and cables for one year. (March 6th.)

STOKE NEWINGTON.—Electricity Department. Transformers, e.h.p. and l.p. switchgear. (See this issue.)

Manchester.—March 25th. Electricity Committee. Service cut-outs and cables for one year. (March 6th.)

March 23rd. Oil-immersed reactors, transformers, switchboard and fire-extinguishing equipment. (March 6th.)

April 9th. Static transformers for one year. (See this issue.)

New Zealand.—WELLINGTON.—May 19th. Public Works Tenders Board. 11,000-V switchgear and metering equipment. (T.Y. 10426.)*

May 22nd. Post and Telegraph Department. Telephone switchboard cable. (T.Y. 10430.)*

AUCKLAND.—April 28th. Harbour Board. Three 5-ton electric capstans. C. R. Butters, 100, Clifden Road, E.5 (deposit £2 2s.).

Portsmouth.—March 30th. Electricity Department. Substation e.h.p. and l.p. switchgear and steel kiosks with switchgear for one year. (March 6th.)

Oldham.—March 23rd. Electricity Committee. Cable. (See this issue.)

Pontardawe.—March 30th. Electricity Department. Materials for one year. (See this issue.)

Salford.—March 25th. City Council. Electrical installations in 292 flats in Eccles New Road. City electrical engineer, Electricity Department, Frederick Road.

South Africa.—CAPE TOWN.—March 25th. Electricity Department. Ironclad service cut-outs. (T.Y. 10393.)*

April 1st. Twenty-five automatic street lighting controllers and accessories. (T.Y. 10424.)*

PRETORIA.—March 27th. Union Tender and Supplies Board. Switchboard cords. (T.Y. 10392.)*

BLOEMFONTEIN.—April 6th. City Council. Turbo-alternator, condenser unit with coupling transformers, switchgear, cables, &c. (T.Y. 10401.)*

JOHANNESBURG.—April 18th. City Council. Electric lamps during the year commencing August 1st, 1936. (T.Y. 10422.)*

Stratford-on-Avon.—March 18th. Deep-borehole, electrically-driven multi-stage pumping plant with accessories at the Warwick Road pumping station. F. W. Jones, borough surveyor, Municipal Offices (deposit £2 2s.).

Swinton & Pendlebury.—March 16th. Electricity Department. Materials for one year. (March 6th.)

Watford.—March 23rd. R.D.C. Three electrically driven centrifugal pumps (one 20,000 gal. per hr. and two 6,000 gal. per hr. each), and one oil-engine-driven pump with accessories for the Aldenham sewage works. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £2 2s.).

Weymouth and Melcombe Regis.—March 30th. L.p. cable. (See this issue.)

Whittingham (NR. PRESTON).—March 25th. Committee of Visitors for the County Mental Hospital. Electric lamps for twelve months to March 31st, 1937. J. Rupert Bishop, clerk and steward.

Worthing.—March 19th. Electricity Department. Cables for one year and a transformer kiosk sub-station. (March 6th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Barrow-in-Furness.—Electricity Committee. Accepted. Two switches (£46 each).—British Thomson-Houston Co., Ltd. Extraction pump and ejector air pump (£455).—Vickers-Armstrong, Ltd. One 500-kVA transformer (£213).—British Electric Transformer Co., Ltd. Switchgear (£285).—Metropolitan-Vickers Electrical Co., Ltd.

Eccles.—Electricity Committee. Accepted. Cables for twelve months.—British Insulated Cables, Ltd.; Callender's Cable & Construction Co., Ltd.

Glasgow.—Corporation Sub-committee. Accepted. Internal telephone system for the Town Clerk's office (£393).—Dictograph Telephones, Ltd.

Health Committee. Accepted. Electric lighting at Gorbals Clinic (£966).—D. Henderson.

Hertfordshire.—Health Committee. Accepted. Electric alterations at Hill End Hospital: Switchgear (£390).—English Electric Co., Ltd. Cable and works (£238).—Electrical Installations, Ltd.

Leeds.—Electricity Committee. Accepted. Cables.—Enfield Cable Works, Ltd. (£6,444); Edison Swan Cables, Ltd. (£538); Hackbridge Cable Co., Ltd. (£646); Derby Cables, Ltd. (£620); Macintosh Cable Co., Ltd. (£122).

Highways Committee. Accepted. Traffic signals (£2,361).—Automatic Electric Co., Ltd.

London.—L.C.C. Hospitals and Medical Services Committee. Electric lighting, power, telephones, fire alarms, bells and clocks in connection with the reconstruction of wards at the North Eastern Hospital, South Tottenham. (Alternative tenders were invited for (a) a system of cables and pillars with controlling switchgear so that the service cable to any block could be isolated without interfering with other blocks, and (b) a system of cables and pillars having three or four blocks connected to one service cable):—

	(a) £	(b) £
B. French	9,545	9,445
Buchanan & Curwen, Ltd.	10,090	9,935
T. Clarke & Co., Ltd.	10,150	10,024
G. E. Taylor & Co.	10,340	10,242
Pinching & Walton	10,421	10,300
Read & Partners, Ltd.	10,453	10,403
Bell Bros. & Co. (London), Ltd. ...	10,471	10,350
H. J. Cash & Co., Ltd.	10,574	10,516
Blackburn, Starling & Co., Ltd. ...	10,597	10,525
A. Hawkins & Sons	10,998	10,938
Electrical Installations, Ltd.	11,778	11,723
A. Dean & Co., Ltd.	11,869	11,779
Arthur Cozens	14,292	13,992
Chief engineer's comparable estimates	10,060	9,850

The lowest tender for scheme (a), that of B. French at £9,545, was accepted.

Liverpool.—Clarence Dock Power Station (Special) Committee. Recommended. One 50,000-kW turbo-alternator set with auxiliaries (£177,265) and pipes and valves in connection with this set (£6,579).—Metropolitan-Vickers Electrical Co., Ltd. Three water-tube boilers, including pipes and valves (£251,000).—Babcock & Wilcox, Ltd. Switchgear for the control of alternators, feeders and auxiliary switchgear (£118,000).—British Thomson-Houston Co., Ltd.

Hospitals Committee. Accepted. Period supplies of electrical equipment required at various hospitals and institutions.—B.I. Cables, Ltd.; J. H. Tucker & Co.; G.E.C.; Falk,

Stadelmann & Co.; Lind & Co.; G. P. Dennis, Ltd.; Smith & Cookson; Downes & Davies; Advance Lamp Co.; Dodd & Oulton, Ltd.; Baxendale & Co.; Howitt & Co.; Mersey Cable Works, Ltd.

Passenger Transport Committee. Recommended. Fifty car sets of bogie trucks, including brakes (£532 per set).—E.M.B. Co., Ltd. Fifty car sets of electrical equipment, including four motors for each car (£560 per set).—General Electric Co., Ltd. Fifty sets of control gear, including controllers, resistances, circuit-breakers, &c. (£283 per set).—Metropolitan-Vickers Electrical Co., Ltd.

Plymouth.—Electricity Committee. Accepted. Transformers and l.p. armoured switchgear.—General Electric Co., Ltd. E.h.p. switchgear.—A. Reyrolle & Co., Ltd. Wireless rectifiers.—Wireless Trade Service Co. Meters.—Ferranti, Ltd.; Aron Electricity Meter, Ltd.

Stores Committee. Accepted. D.c. motors, &c.—J. Cashmore, Ltd.; Glasgow Electrical Engineering Co., Ltd.; Engineering Stores and Services, Ltd.; W. Elliott; Britannia Manufacturing Co., Ltd.

Portsmouth.—Health Committee. Accepted. Rewiring at St. Mary's Hospital (£1,099).—C. Birt.

Electricity Committee. Accepted. Water-tube boilers (£152,935).—Clarke Chapman & Co., Ltd. Turbo-alternator (complete) (£99,271).—British Thomson-Houston Co., Ltd. House service cut-outs.—British Insulated Cables, Ltd. One 5,000-kVA transformer (£2,004).—British Electric Transformer Co., Ltd.

South Shields.—Accepted. Repairs to the battery at the electricity station (£305).—Tudor Accumulator Co., Ltd.

Town Council. Accepted. Electrical installations in houses in Richardson Terrace (£245).—Nelson & Sons. Switchgear in connection with additions to the Quarry Lane sub-station (£760).—A. Reyrolle & Co., Ltd.

Watford.—Electricity Committee. Accepted. Switchgear (£1,333).—Metropolitan-Vickers Electrical Co., Ltd.

Wolverhampton.—Electricity Committee. Accepted for twelve months.—Cables, v.i.r. twin flexible cords and wood channelling.—Callender's Cable & Construction Co., Ltd.; Macintosh Cable Co., Ltd. P.b.j. cable and binding wire.—Enfield Cable Works, Ltd. H.d. copper conductors.—British Insulated Cables, Ltd. Insulating tapes, jointing compound, dividing boxes and tee joints.—Callender's Cable & Construction Co., Ltd. Conduits, troughing and service joint boxes.—Doulton & Co., Ltd. House service cut-outs and street-lighting lamp standards.—Revo Electric Co., Ltd. Power transformers.—Electric Construction Co., Ltd. 6-kV metal-clad switchgear.—A. Reyrolle & Co., Ltd.

Worthing.—Street Lighting Committee. Accepted. Lighting columns.—J. Every, Ltd.; Revo Electric Co., Ltd.; Stanton Ironworks, Ltd. Lighting units, brackets, lanterns and refractors.—Brighton Lighting and Electrical Engineering Co., Ltd. Time switches.—Venner Time Switches, Ltd.; Bowden Bros., Ltd.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March 19th. Institution, London. 6 p.m. "Cineradiography." Dr. Russell J. Reynolds.

Tees-Side Sub-Centre.—Monday, March 16th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "Equipment and Performance of Steel-Tank Rectifier Traction Sub-Stations Operating on the London Underground Railways." Mr. A. L. Lunn.

East Midland Sub-Centre.—Tuesday, March 17th. The College, Loughborough. 6.45 p.m. Paper by Mr. A. L. Lunn.

North Midland Centre.—Tuesday, March 17th. Hotel Metropole, Leeds. 7 p.m. Informal discussion on "How to Reduce Distribution Costs." To be opened by Mr. G. A. Vowles.

North-Eastern Centre.—Wednesday, March 18th. Grand Assembly Rooms, Newcastle-upon-Tyne. Annual dinner and dance.

Sheffield Sub-Centre.—Wednesday, March 18th. Royal Victoria Hotel, Sheffield. 7.30 p.m. Particulars to be announced.

South Midland Centre.—Wednesday, March 18th. Joint meeting with the Institutions of Civil and Mechanical Engineers. Discussion on "The Trend of Transport."

Transmission Section.—Wednesday, March 18th. Institution, London. 6 p.m. Discussion on "Operating Problems."

Meter and Instrument Section.—Friday, March 20th. Institution, London. 7 p.m. Informal discussion.

Electrical Power Engineers' Association (*London Technical Group*).—Monday, March 16th. Caxton Hall, London, S.W.1. 7.15 p.m. "Some Chemical Aspects of Boiler Plant Maintenance." Mr. A. A. Pollitt.

Association of Supervising Electrical Engineers.—Tuesday, March 17th. E.L.M.A. Lighting Service Bureau, London, W.C.2. 7.15 p.m. "Industrial Switchgear." Mr. G. L. Walker.

Electrical Contractors' Association.—Tuesday, March 17th. Savoy Hotel, London, W.C.2. 6.30 for 7 p.m. Dinner.

Diesel Engine Users' Association.—Wednesday, March 18th. Pagani's Restaurant, London, W.1. 7.15 for 7.30 p.m. Annual dinner.

Institution of Engineers and Shipbuilders in Scotland.—Wednesday, March 18th. 129, Bath Street, Glasgow. 7.15 p.m. Joint meeting with the Scottish branch of the Institution of Structural Engineers. "Welded Bridges." Mr. A. R. Moon.

Batti-Wallahs' Society.—Friday, March 20th. Hotel Metropole, London, W.C.2. Annual dinner and dance.

Birmingham Electric Club.—Friday, March 20th. Grand Hotel, Birmingham. 7 p.m. "Service Rendered by Electricity to Modern Medicine and Surgery." Mr. B. Leggett.

Electrical Development Association.—Friday, March 20th. Savoy Hotel, London, W.C.2. 12.45 for 1 p.m. Annual luncheon.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, March 21st. Cardiff. "Maintenance and Testing of Electrical Plant Including Protective Systems." Mr. H. C. Davies.

Finsbury Technical College Old Students' Association.—Saturday, March 21st. Trocadero Restaurant, London, W.1. 6.30 for 7 p.m. Annual dinner.

Notes

E.I.B.A. Matters

Following upon our reference on page 369 last week to the annual meeting and luncheon of the Electrical Industries Benevolent Association we learn that at the annual meeting on April 3rd (12 noon) the following members of Council are due to retire and are eligible for re-election:—Sir Andrew Duncan and Messrs. George Balfour, A. G. Beaver, E. A. Gatehouse, L. C. Penwill and R. P. Sloan. Sir A. Duncan is not seeking re-election, and Messrs. G. Balfour and R. P. Sloan are becoming vice-presidents, an office which carries a seat on the Council. The following additional nominations have been received:—Sir Noel Ashbridge, Messrs. A. Albrecht, A. Brammer, J. W. Beauchamp, E. Barralet, W. A. Jones, D. G. Strachan, W. Shearer, M. Whitgift and H. T. Young. Any further nominations should be submitted not later than March 20th to the Executive Officer, Mr. A. Hugh Seabrook, 36, Kingsway, London, W.C.2. The revision of rules will be considered at an extraordinary general meeting at 11.45 a.m., and on May 5th another meeting will be held to confirm the alterations.

Mining Engineers' Dinner

The South Wales Branch of the Association of Mining Electrical Engineers held its annual dinner at the Park Hotel, Cardiff, on March 7th under the chairmanship of the branch president, Mr. Howard Williams. The guests included Mr. F. Ll. Jacob, president, South Wales Institute of Engineers, Mr. J. R. Cowie, vice-president of the Association, Mr. S. B. Haslam, branch vice-president, Mr. H. Manley Roberts, chairman, Western Centre, I.E.E., Major H. H. Johnson, Colliery Managers' Association, Prof. T. D. Jones, of the Cardiff University College Engineering Department, and Mr. L. Howles, general manager, South Wales Power Co. During the speeches reference was made to the shortage of the right sort of young men to take up official positions in collieries, both on the management and the technical sides. It was agreed that an effort should be made by both the managements and kindred associations to attract the right material. It was also urged that the Association should not allow itself to become so "highbrow" that the man who had to take off his coat at the colliery would be unwilling to stand up at meetings and state his views.

E.A.W. Activities

The annual luncheon of the Birmingham and District Branch of the Electrical Association for Women took place at the Grand Hotel on March 4th and was attended by 350 members and friends. Responding to the toast of "The Association," Miss Caroline Haslett, director of the E.A.W., suggested that the Birmingham Branch should follow Bristol's example and build an all-electric house. She mentioned that it was intended to arrange classes for domestic servants throughout the country, certificates being given to those who passed practical tests. The status of domestic service would thus be raised considerably. The chair at the luncheon was taken by Mrs. H. K. Beale, and other speakers were the Lord Mayor of Birmingham, the Earl of Dudley and Lady Brooks.

The Belfast Association of England

The annual dinner of the Belfast Association of Engineers was held on March 7th, when Mr. H. R. Ayton (president) proposed the toast of "Prosperity to Northern Ireland," Mr. F. E. Ribbeck (chairman of Messrs. Harland & Wolff) responding. The toast of "The Kindred Associations" was proposed by Mr. A. F. Shillington, to which Mr. W. E. M'Connell (vice-president of the Institute of Marine Engineers) replied.

Appointments Vacant

Installation engineer for Derby Electricity Department.

Switchboard attendant for First Garden City, Ltd., Letchworth, Electricity Department.

Mains assistant for Walthamstow Electricity Department.

Lady cooking demonstrator for Shoreditch Electricity Department.

Lady demonstrator for Clacton Electricity Department.

Electrical inspectors for Surrey County Council.

Accountant and mechanician for East Sussex County Council for the Brighton and Hove dog racecourse stadium.

Inspector of machinery for the Mines Department of the F.M.S. Government.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the products of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Castings in soft, rustless, magnetic iron.

ETNA switchgear.

ELUX appliances.

REXIT non-laminated bakelite board.

PESTOTIN fuse wire.

SOLELECTRIC mixers.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Lt.-Col. W. A. Vignoles, D.S.O., was elected president of the Batti-Wallahs' Society at the annual meeting on March 3rd. Mr. M. Whitgift was re-elected hon. secretary and treasurer, and the following were elected to serve on the Committee: Messrs. G. M. B. Hilton, A. F. Harmer, J. McCaffery, A. E. Mohring, H. S. May and A. Williams.

Mr. W. Millner, B.Sc., A.M.I.E.E., sales manager of the London Associated Electricity Undertakings, Ltd., was elected a member of the Committee of Management of the Universal Cookery and Food Association at the annual meeting held on March 6th. For many years past the Association has received the co-operation of the gas industry, and the election of Mr. Millner as a representative of the electrical industry shows the increasing popularity that electric cooking enjoys in professional culinary circles.

Ald. P. J. Roberts, chairman of the Worcester Electricity Committee for twenty-one years, was presented with a clock and a silver cigarette case last week at the tenth annual dinner of the Worcester Electricity Works Recreation Club.

Mr. R. V. Weare, city electrical engineer, has been appointed by the Chichester City Council as a full-time officer at a salary of £650 per annum. Mr. Weare was retained in the service of the undertaking when it was acquired in 1922, but hitherto he has not been a full-time officer. To compensate for the loss of private consulting practice, his salary has been increased from £590 to £650.

Lord Eltisley.—Lord Eltisley of Croxton, the president-elect of the British Electrical Development Association, was, as Sir Douglas Newton, Conservative member for Cambridge from 1922 until 1933. During that period in the House of Commons he was prominently identified with agricultural interests and questions, and closely investigated rural electricity supply development matters. He has had much practical experience of rural supply, and, according to the current number of the E.D.A. *Bulletin*, extensive use of electricity has been made on his Cambridgeshire estate for many years. The electrical applications there include threshing, pumping, grinding pig food, working sack hoists, operating fruit grading, corn cleaning, potato sorting, sawmill driving, heating sties for newly farrowed pigs, warming milk for new-born lambs, and driving elevators for stacking straw and hay. Frequently fourteen motors are in use, supply for these being taken from the supply undertaking and distributed to farms and other buildings. Lord Eltisley will thus come to the presidential chair of E.D.A. with a specialised acquaintance with one of the pressing departments of electricity supply. He is a companion of the I.E.E., a member of the Standing Conference on Electricity Supply in Rural Areas, and a director of Edmundson's Electricity Corporation and other important electricity supply companies. Lord Eltisley was made a K.B.E. in 1919, and received a peerage in 1934.

[*Press Portrait Bureau*
Lord Eltisley

Mr. W. R. Barclay, O.B.E., the new president of the Institute of Metals, was inducted into the chair by Dr. H. Moore, C.B.E., the retiring president, at the annual meeting held on Wednesday and Thursday last week. Mr. Barclay entered the service of Messrs. Henry Wiggin & Co., Ltd., in 1919, became technical director in 1923, and subsequently managing director. He was appointed consulting metallurgist to the Mond Nickel Co., Ltd., in 1931.

Mr. H. de C. Falle, A.M.I.E.E., O.B.E., (Mil.), who has been with Laurence, Scott & Electromotors, Ltd., for the last five and a half years, informs us that he has resigned his position of sales manager. Previously he was sales manager of Ruths Steam Storage, Ltd., and for several years before that he was on the engineering sales staff of the General Electric Co., Ltd. During the War he served in the Navy, and retired with the rank of lieut.-commander. Mr. Falle is a director of Nomy Bearings, Ltd.

Mr. R. E. Jardine, manager of the machinery, metal and mercantile departments of Messrs. Noyes Bros. (Melbourne) Proprietary, Ltd., is visiting England and desires to meet people who wish to establish connections in Australia. He will arrive in London about April 24th; letters to him can be addressed c/o Messrs. McDonald Scales & Co., Coventry House South Place, Moorgate, E.C.

Mr. R. Illingworth, of Poplar, whose career was mentioned in our last issue, was formerly deputy electrical engineer at Plymouth, not Portsmouth as was stated.

Mr. C. Baron, of the Portsmouth Corporation Electricity Department, has been appointed commercial assistant with the Wolverhampton Corporation Electricity Department.

Mr. E. J. Jennings, F.C.I.S., Comp. I.E.E., was entertained by the staff of the City of Birmingham Electric Supply Department to a complimentary dinner at the Great Western Hotel, Birmingham, on March 5th, upon his retirement from the position of secretary and commercial manager after eighteen years service with the Corporation. Mr. F. Forrest, chief engineer and manager, paid a tribute to Mr. Jennings's services to the undertaking and to his national reputation as an expert in financial, legal and commercial electrical matters. Alderman Sir Percival Bower, M.B.E., J.P., chairman of the Electric Supply Committee, testified to the high opinion and appreciation of Mr. Jennings's work which existed among members of the Committee, who had passed a resolution which was to be illuminated and presented to him. Mr. Alderman Ager, Councillor Major Sale, and Mr. Evans (departmental secretary) also spoke. Mr. Jennings, responding, expressed his gratitude to the staff for their support. He was presented with a radiogramophone, and Mrs. Jennings received a dressing case. A musical programme was given by members of the staff.

A group at the Preston Electrical Exhibition
Left to right: Sir John Brooke (vice-chairman, Electricity Commission); the Mayor and Mayoress (Councillor and Mrs. E. Ley); Ald. Rhodes (chairman of the Electricity Committee); and Mr. D. Adams (borough electrical engineer).

Mr. W. H. Cooke, borough electrical engineer of Luton, who would normally retire on October 1st next, has had his period of service extended by the Corporation until March 6th, 1937.

Obituary

Major G. Jacques.—We regret to record the death of Major Gerald Jacques, secretary of the Western Electric Co., Ltd., which occurred on March 3rd, at Torquay, at the age of fifty-one. Major Jacques was associated with the Bell Telephone System for thirty years, joining the Bell Telephone Manufacturing Co. as assistant chief inspector in 1906. He subsequently became head of the European information department of the International Western Electric Co. During the War he served, with distinction, in the R.F.C. as radio officer, and saw service in France, Egypt and the Middle East. He rejoined the International Western Electric Co. in 1920, continuing when the company was taken over successively by the International Standard Electric Co. and the Western Electric Co. He became general manager of the latter company in 1929 and secretary in 1931.

The late Major G. Jacques

Will.—The late **Sir Richard T. Glazebrook,** left estate of the gross value of £30,835, with net personalty £28,268. Among his bequests he left scientific books and pamphlets to the National Physical Laboratory, £100 to its sports club, and a portrait of himself to his wife for life and then to the Laboratory.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

E. & H. P. Smith, Ltd.—Public company. Registered March 6th. Nominal capital, £100,000 in 2s. shares. Objects: To adopt agreements with (1) M.A.C., Ltd., (2) E. Smith and (3) H. P. Smith, and to carry on the business of factors, distributors, merchants and manufacturers of and dealers in wholesale and retail, electrical and wireless apparatus, heating, lighting and domestic appliances, &c. The subscribers are: O. J. Hook, "Dorana," Grange Crescent, Chigwell, C. G. Lloyd, 106, Huxley Road, Leyton, E.10, and five others. The directors' borrowing powers are restricted to an amount not exceeding the nominal capital. Solicitors: Stephenson, Harwood & Tatham, 16, Old Broad Street, E.C.

Nevelin Electric Co., Ltd.—Private company. Registered March 6th. Nominal capital, £30,000 in £1 shares (15,000 6 per cent. cumulative preference and 15,000 ordinary). Objects: To carry on the business of manufacturers, installers, assemblers, and repairers of and dealers in mercury arc and oxide cathode bulbs and rectifiers, dynamos, motors, armatures, magnetos, rubber, insulating materials and general electrical plant, railway locomotives, tramcars, motor omnibuses, &c. The subscribers are: C. Leven, M.I.E.E., 107-111, New Oxford Street, W.C.1, and L. J. Hitchcock, 849, Harrow Road, N.W.10. Solicitors: Freshfields, Leese & Munns, 31, Old Jewry, E.C.2.

Motherwell Relay Service, Ltd.—Private company. Registered March 6th. Capital, £1,000 in 750 ordinary shares of £1 each and 5,000 ordinary shares of 1s. each. Objects: To construct and maintain wireless signal stations, and to carry on the business of consulting wireless experts, &c. The directors are: J. A. Parish (permanent managing director), 38, Sherburn Terrace, Consett, Co. Durham; and M. S. Winston, Victoria, Winlaton Mill, Blaydon-on-Tyne. Secretary: W. F. Reed.

Peterborough Radio Co., Ltd.—Private company. Registered March 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of designers, manufacturers and repairers of, agents for and dealers in wireless, television and electrical apparatus, &c. The directors are: R. E. Rossiter and Mrs. F. E. Rossiter, 42, Brampton Road, Cromwell Estate, Cambridge. Secretary: R. E. Rossiter.

Felgate Radio Co., Ltd.—Private company. Registered March 6th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of, agents for and dealers in radiograms, gramophones, sound-producing image-producing, telegraphic, telephonic, televisual and wireless machines and apparatus, &c. The directors are: F. J. Benzimra, 1a, Addison Crescent, W.14, and two others. Registered office: Felgate House, Studland St., Hammersmith, W.6.

A. E. Plumbe & Co., Ltd.—Private company. Registered March 7th. Capital, £500 in £1 shares. Objects: To carry on the business of dealers in and manufacturers of musical instruments of all kinds, wireless, radio, television, electrical and telephone apparatus, &c. The subscribers are: Mrs. A. E. Plumbe, the Electrical Stores, Liverpool Road South, Maghull, Lancs; and F. H. Longworth, 106, Moscow Drive, Liverpool, 13. Registered office: 132, The Albany, Old Hall Street, Liverpool.

Whitaker Electric (1936), Ltd.—Private company. Registered March 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of factors of electrical apparatus, electrical equipment and accessories, &c. The directors are: R. N. Martineau, address not stated; and W. B. Pearson, Polebrook House, Golden Square, W.1. Registered office: Polebrook House.

R. Kilpatrick & Co., Ltd.—Private company. Registered in Edinburgh March 5th. Capital, £10,000. Objects: To carry on the business of makers of and dealers in electrical and/or chemical appliances and goods of all kinds, &c. The directors are: R. Kilpatrick, Dunira, Westwood Terrace, West Newport, Fife, and two others. Registered office: 5, Albert Square, Dundee.

Rexicon, Ltd.—Private company. Registered February 28th. Capital, £500. Objects: To carry on the business of manufacturers, importers and exporters of, agents for and dealers in electrical, wireless, sound recording, television and cinematograph apparatus, &c. The directors are: S. Marks, Chelmsford Square, Kensal Rise, W., and two others. Solicitors: C. A. Maddin & Co., Surbiton.

Economic Electrical & Mechanical Engineering Co., Ltd.—Private company. Registered March 4th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical and mechanical engineer carried on by R. B. Parry as the Economic Electrical & Mechanical Engineering Co., at Cardiff. The subscribers are: E. Gough, 9, Gilligan Gardens, Cardiff, and two others. R. B. Parry signs as director. Registered office: 16, Quay Street, Cardiff.

Multiplex (Manchester), Ltd.—Private company. Registered February 29th. Capital, £1,000. Objects: To carry on the business of manufacturers of and/or dealers in electric lamps of all types; gas, electrical and radio goods, &c. The subscribers are: E. P. Griffiths, 104, Priory Road, Hornsey, N.8, and A. M. Barron, 54, Clarence Avenue, Ilford. Registered office: Aldwych House, Aldwych, W.C.2.

New Radiant, Ltd.—Private company. Registered March 6th. Capital, £1,000 in £1 shares. Objects: To acquire the business of a manufacturer of and dealer in electrical and other signs carried on by Geo. T. Sugden at 19, Eastcheap, E.C. The directors are: G. T. Sugden, 8, Longfield Road, Ealing, W.5; and T. B. C. Harris (chairman), 31a, Kensington Place, W.8.

Radio Services (Porthcawl), Ltd.—Private company. Registered March 6th. Capital, £1,000 in £1 shares. Objects: To acquire the business of a wireless and electrical engineer carried on by Reginald I. Francis at Newton, Porthcawl. The directors are: R. I. Francis, "Ravendale," Newton, Porthcawl, and two others. Registered office: The Garage, County Road, Newton, Porthcawl.

Returns of Electrical Companies

Ismay Industries, Ltd.—The nominal capital has been increased by the addition of £400,000, beyond the registered capital of £750,000. The additional capital is divided into 150,000 first preference shares of £1 and 1,000,000 ordinary shares of 5s. each. On February 6th, 1936, 300,000 ordinary shares were allotted for cash with 5s. per share called up, plus a premium of 2s. per share. The allottees were Morais Hall, Ltd., Alderney, C.I. (180,000), Alan D. Roberts (70,000), and F. S. Lewis (50,000).

Perak River Hydro-Electric Power Co., Ltd.—Satisfaction (1) to the extent of £1,600,000 and premium of 5 per cent. on January 8th, 1936, of trust deeds (one supplemental), dated November 12th, 1926, and July 30th, 1929, and registered November 19th, 1926, and August 1st, 1929, respectively, and (2) to the extent of £850,000 on same date, of charge dated January 29th, 1930, and registered February 1st, 1930.

Christy Brothers (Wireless Relays), Ltd.—Capital, £20,000 in £1 shares (increased from £5,000 on October 14th, 1935). Return dated October 23rd, 1935. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil. On November 18th, 1935, a further 7,000 shares were allotted, payable in cash and fully called up.

West London and Provincial Electric and General Trust, Ltd.—Particulars have been filed of 3½ per cent. redeemable debenture stock 1956/76, to secure £200,000 authorised January 9th, 1936, and covered by trust deed dated February 26th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: General Investors and Trustees, Ltd.

Relay Developments, Ltd.—Capital, £25,000 in 20,000 ordinary shares of 5s. and 20,000 7 per cent. cumulative preference shares of £1. Return dated December 18th, 1935. 8,356 ordinary and 6,438 preference shares taken up. £8,527 paid. Mortgages and charges, nil.

Alfred Diggle & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 13th, 1936, to secure all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

Edgware and Stanmore Electrical Co., Ltd.—Capital, £1,000 in 20,000 ordinary shares of 1s. Return dated November 20th, 1935. All shares taken up £1,000 paid. Mortgages and charges, nil.

W. and A. G. Lambert, Ltd.—S. H. Davis, 18, Belmont Road, Bearwood, Smethwick, was appointed receiver and manager on February 13th, 1936, under powers contained in debentures dated November 16th, 1933.

Wiring, Ltd.—Capital, £2,500 in 2,000 preference shares of £1 and 10,000 ordinary shares of 1s. Return dated December 26th, 1935. All shares taken up. £2,500 considered as paid. Mortgages and charges, nil.

Electro-Metal Deposits, Ltd.—Capital, £1,500 in £1 shares. Return dated February 12th, 1936. All shares taken up. £1,500 paid. Mortgages and charges, £500.

Winstanley & Lambert, Ltd.—Mortgage dated February 26th, 1936, to secure £1,000 charged on 8, Endbutt Lane, Great Crosby, Lancs. Holder: W. Winstanley, Beachmount, 29, Brooke Road West, Waterloo, Lancs.

M. C. Dizer, Ltd.—Particulars filed of £10,000 debentures, authorised February 12th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £4,800.

City Notes

The North Metropolitan Electric Power Supply Co.—Presiding at the annual meeting held on Tuesday last, Lord Ashfield (chairman) said that while the company's policy had been to secure for everybody in its area a supply of electricity at a common level of charges, it was not the cost of generation which determined the charge for electricity to consumers, but rather the cost of providing and maintaining the system of distribution, and this varied considerably as between towns and sparsely populated areas. About 95 per cent. of the premises in the newly developed districts in the urban parts of their area, such as Wembley, Wealdstone, Edgware and Kingsbury, were connected to the mains, and although the percentage was not so high in housing schemes built before electricity was generally available, these were now being rapidly wired, and 78 per cent. of the premises in the whole urban area were now taking a supply. In the rural area where the population was grouped mainly in small villages and isolated houses and towns such as Hertford, Bishop's Stortford, Ware, Stevenage and Royston, and where factories were few, the total number of premises connected was about 50 per cent. The rates of charge, although not the same throughout the area, were gradually becoming standardised and to domestic consumers who took the "all-in" rate this was especially true, for although there was a small variation in the fixed charge as between the rural and urban districts, the "follow-on" rate was ½d. per kWh for the whole Northmet area, and rates for large power users were nearly uniform in all districts. Sales of electricity during the year amounted to 495,200,000 kWh, an increase of 17 per cent. over 1934, and the number of consumers supplied directly or indirectly totalled 296,606, an increase of 16.4 per cent. The consumption of electricity per domestic consumer supplied directly by the company had risen from 527 kWh in 1934 to 552 kWh in 1935, and the average price per kWh paid by all the domestic consumers had fallen from 2.08d. per kWh in 1934 to 1.83d. in 1935. The average price on the "all-in" rate had dropped to 1.19d. With the "follow-on" charge under the "all-in rate" fixed at ½d. per kWh throughout the year, the

average price per kWh during 1935 would be lower. To meet increased demands for electricity there was an expenditure during the year of £893,000 on extensions and improvements which included 232 miles of new underground mains, fifty-two miles of overhead lines, ninety-nine new sub-stations, equipment and expenditure on public street lamps, meters and other apparatus in consumers' premises and new showrooms. The sales through the showrooms of electrical fittings and appliances amounted to £192,000, an increase of 40 per cent. over the previous year. In the interest of the grid scheme the Central Electricity Board had restricted the output from the Willesden power station and with the Brimsdown "A" station being temporarily shut down, the energy generated by these stations was about 12,000,000 kWh less than in 1934, but that taken from the C.E.B. increased from 57,000,000 to 140,000,000 kWh. A direction had been received from the C.E.B. for the extension of the Brimsdown "A" station by the installation of two turbines with a total capacity of 52,600 kW and two Loeffler boilers, generating steam at a pressure of 2,000 lb. per sq. inch and at a temperature of 740° F. Although these boilers were of foreign design, arrangements had been made to manufacture them in England. The two subsidiary companies had again made satisfactory progress during the year and the Harrow Electric Light & Power Co., Ltd., had increased its output by 14 per cent. and the number of consumers by 17.6 per cent. Reductions in the rates of charges in this company's area were to be introduced at an early date. With regard to the future, there was no sign of a diminution in building activity, and it seemed that the steady influx of population into their area would be maintained. Existing domestic consumers were using more electricity, and there was an increase in the consumption for industrial purposes due to the expansion of existing factories and to the increased number of new factories being built in their area.

The North-Eastern Electric Supply Co., Ltd., reports a profit for 1935 of £1,096,505, as compared with £1,088,291 last year. From this is deducted interest on debenture stocks, &c. (£230,959), sinking fund for redemption of debenture stocks (£65,515), transfer to reserve for special depreciation and contingencies, other than equalisation of dividends (£235,000), and transfer to reserve for plant renewals and improvements (£70,000), leaving a balance of £495,030, which with £134,083 brought in makes £629,113 available. The final ordinary dividend is 2½ per cent., maintaining the distribution for the year at 6 per cent., and £158,036 is carried forward. The sum of £2,706,407 has been added to the capital expenditure in respect of ordinary extensions to the transmission and distribution systems and on account of the new Dunston power station. An issue of £1,500,000 3¼ per cent. consolidated debenture stock was made in May last and was fully subscribed. Satisfactory progress has been made during the year in the standardisation of frequency under the North-East England Electricity Scheme, 1929, and the work is now approaching completion. Under an agreement entered into between the company and the Central Electricity Board, the company has agreed to bear a portion of the cost of completing the change of frequency and a special reserve to meet this cost appears in the accounts. Meeting: March 17th.

The Metropolitan Electric Supply Co., Ltd., held its annual meeting on Tuesday last when Mr. George Balfour, M.P. (chairman), who presided, referred to the loss that the company had sustained by the death of Mr. George Verity, a director. Mr. Balfour then said that it had been the policy of the board for several years to make the charges for electricity such as would induce widespread use of this service and in pursuit of this policy £1,500,000 had been spent during the past four years in the subsidiary companies and outer London areas, and £250,000 in the London area, and it was not until this year that they had realised the benefit of these efforts. The total sales in 1935, omitting sales in bulk, had increased to 217,000,000 kWh, as compared with 90,500,000 kWh in 1927, whereas the revenue had only increased from £387,000 to £440,000, while the price per kWh fell from 2.63d. to 1.65d. These figures showed a 140 per cent. increase in sales for an improvement of less than 14 per cent. in revenue. A multiplicity of tariffs was necessary if the individual consumer was to get the best tariff applicable to his particular load. The question of the best method of charging was a complicated problem, and although a simple tariff system would suit the electricity supply industry the consumer would suffer. During the year they had acquired nearly the whole of the ordinary shares of the Notting Hill Electric Lighting Co., Ltd. A record number of 17,744 new consumers was connected last year, compared with 14,468 in 1934, and 303,974,000 kWh was sold by the "Metesco" group, as against 262,432,000 kWh in the previous year. Of this increase only 5,020,000 kWh was supplied in the London area. The charges for the bulk supply from the London Power Co., Ltd., applied only until the end of last year and were now to be revised.

The South Wales Electric Power Co. reports a net revenue for 1935 of £203,346, as against £182,604 for the preceding year. After deducting debenture interest, &c., and placing £72,000 to depreciation and reserve account, there is a balance of £35,349. It is proposed to pay a dividend of 3½ per cent. on £1,000,000 ordinary stock (against 2 per cent. on £677,850 of stock for the whole of 1934 and 2 per cent. on £322,150 of stock for one month only), and to carry forward £5,797. The directors have issued at par, with rights as from January 1st last, £100,000 ordinary stock, and applied the proceeds towards satisfaction of a loan. Meeting: March 13th.

Davis & Timmins, Ltd., report a net profit for 1935 of £17,119, as compared with £13,339 in the preceding year. It is proposed to pay an ordinary dividend of 8 per cent. (against 6 per cent.), and to carry forward £18,811. In view of the increased trade activity and the continued expansion of the business the directors propose to increase the capital to £200,000 by the creation of 30,000 £1 ordinary shares. It is the present intention of the directors shortly to make a small issue which will, in the first instance, be offered for subscription to shareholders.

The London Associated Electricity Undertakings, Ltd., in its first report for the eleven months ended December last that the revenue received from the constituent companies was £478,959. It is proposed to pay a dividend of 4 per cent. actual (less tax) on the ordinary stock, making 7 per cent. for the year and to transfer £55,000 to a stockholders' reserve. At December 31st the connected load of the constituent companies was 489,339 kW, and the sales during the year totalled 350,000,000 kWh. Meeting: March 19th.

The Telephone & General Trust, Ltd., reports a profit for 1935 of £108,834, as against £106,764 for the preceding year. A final ordinary dividend of 5 per cent. is proposed, making 8 per cent. for the year (unchanged), and it is also proposed to pay a dividend of 8 per cent. on the "A" ordinary shares (same), leaving £56,378 to be carried forward. The report states that the subsidiary companies all showed profits and have been included in the accounts only to the extent to which dividends have been received.

The Hendon Electric Supply Co., Ltd., reports that after charging £8,300 on income tax account and placing £24,201 to repairs and renewals fund, there is a net profit for 1935 of £46,216, as compared with £47,916 in the preceding year. It is proposed to pay a final ordinary dividend of 5¼ per cent., making 7¾ per cent. for the year, tax free (same), and to carry forward £17,289. The sales of electricity increased from 33,851,990 kWh to 38,406,990 kWh. Meeting: March 16th.

The Llanelly and District Electric Supply Co. reports a net revenue for 1935 of £64,595, as against £60,883 in 1934. The ordinary dividend is maintained at 5 per cent., £22,000 is placed to reserve, and £1,475 is carried forward. The report states that the electricity supply business shows a satisfactory improvement.

The National Gas & Oil Engine Co., Ltd., reports a net profit for 1935 of £19,193 (against £13,957 for 1934), which with £4,717 brought in makes £23,910. A dividend on the preference shares for the half-year to June 30th, 1934, was paid in July, and it is now proposed to pay a further year's dividend on these shares, leaving a balance of £9,960 to be carried forward.

The Greengate & Irwell Rubber Co., Ltd., reports a net trading profit for 1935 of £60,148 (against £53,636), to which is added £10,763 brought in. A final ordinary dividend of 1s. per 16s. share is proposed, making 1s. 9d. per share (same), and £14,290 is carried forward.

The City of London Electric Lighting Co., Ltd., reports a net revenue for 1935 of £142,894, plus £35,020 brought in. The ordinary dividend is maintained at 7½ per cent. and £45,071 is carried forward. The sales of electricity increased by approximately 10 per cent.

W. Canning & Co., Ltd., have declared a final dividend of 5 per cent. (same), and a bonus of 12½ per cent. (against 10 per cent.), making a total distribution of 22½ per cent. for 1935 (20 per cent. for 1934).

British Insulated Cables, Ltd., proposes to convert into stock its entire authorised and issued share capital of £2,666,666. An extraordinary meeting to consider the resolution will be held in Liverpool on March 31st.

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during February as compared with the corresponding month of 1935, show an increase of 26 per cent. in kWh sold.

The Rawlplug Co., Ltd., proposes to pay a dividend of 30 per cent. on the ordinary shares for 1935 (against 20 per cent.).

Stocks and Shares

TUESDAY EVENING.

THE crisis that has arisen so dramatically on the Continent is, of course, the outstanding influence over stock and share prices at the present time. The news of the German move came as a shock to markets that were unprepared for an event, which, to many people, had seemed by no means an improbable happening in the future. That it should have come so suddenly is the reason for the widespread nature of its effect upon prices. Quotations gave way in practically every department. Gilt-edged securities led a general fall. Resistance was offered in a few cases, notably amongst certain of the aircraft favourites, but taken as a whole, the Stock Exchange was sharply shaken. Confidence has suffered a blow to recover from which some little time will be needed. It has been said here on many recent occasions that Stock Exchange markets, and investors at large, are so inured to shocks that they can take most blows with philosophic calm. In this particular case, however, the abruptness of the German action was the immediate cause of a cessation of purchases and, accordingly, of allowing sales to exercise a disproportionate effect in most of the markets round the House.

"Scraps of Paper"

Discussing the matter amongst themselves, Stock Exchange members admit that they are not altogether sorry, theoretically speaking, for the turn which international politics have taken. With the important qualification, "provided France keeps her head," it is argued that the present situation may reasonably be expected to conduct the nations along the path of peace. On the other hand, some people maintain that it is impossible to enter into pacts and treaties with a nation whose respect for them is limited simply to self-interest. From the narrow Stock Exchange point of view, it may be said that the falls in prices are due to the holding aloof of buyers. The power to buy is still there, but the inclination to use it is held in check by the uncertainties of the moment. With enterprise, investment and speculative alike, checked so suddenly, it is natural that business should suffer notable contraction.

Electricity Supply Shares

A few more electricity supply companies have issued, during the past week, their annual reports and dividend announcements. There are, now, not many more important announcements to come; the results of the operations of most of the leading companies during the last year are known. The market remains fairly steady. Dividends and reports are uniformly satisfactory, but are not of the kind calculated to stir the market into activity and strength. Most of them are

in accordance with previously formed expectations. The share price-list would present a different appearance if the increase in the number of units sold had been accompanied by a proportionately large increase in the net profits of the companies. Higher revenue from the sale of current is, in many cases, largely offset by the costs of expansion. It is evident, however, from the modesty of the yields offered to investors in this market at current prices, that greater profits and more generous dividends are looked for in coming years. Confidence in the future rests partly on the assumption that a higher standard of economy in the distribution of electricity will be achieved and thereby enable earnings to advance step by step with output.

Declines and Falls

Among the shares of companies which have recently issued dividend announcements or reports, the prices of Bournemouth and Poole, City of London, London Electric and South Metropolitan are, like the dividend distributions, unchanged. Hendons fell 6d. to 56s., and Llanellys 9d. to 25s. 9d. Small declines in the prices of a number of others may be attributed to the general uncertainty rather than to special influences. Clyde Valleys and Electrical Distributions of Yorkshire are each 1s. lower at 45s. and 47s. respectively. Scottish Power show a more substantial loss, being 1s. 9d. down at 42s.

Preference Shares on Offer

A line of 10,000 Shropshire, Worcestershire and Staffordshire Electric Power Company 6 per cent. cumulative £1 preference shares is on offer at 31s. 9d. per share. The yield on the money works out at 3¾ per cent. The profits earned by the company have risen continuously from £175,000 in 1925 to £621,000 in 1934. The amount required to meet the dividend on the preference shares is covered more than three times by current earnings. The company has issued £3,125,000 in 5 per cent. debenture stock. The shares fulfil satisfactorily the requirements of investment that is content to accept a small yield in return for sound security.

Manufacturing and Equipment

The depression, caused by Germany's action, in the market for industrial shares generally, finds natural reflection in the prices of shares in electrical equipment companies. The falls are neither numerous nor particularly significant; they range from 9d. to 2s. 6d. General Electrics, Henley's and Associated Electricals have lost the larger of these two figures. In accordance with their present disposition to move in unison, G.E.C. and Associated lost 1s. more than they gained in the previous week. Associated Electrical preference shares are quoted 1s. lower at 38s., but dealings have taken place up to 39s. and over. The General Electric results are not expected to be published for another three months. Telegraph Constructions fell 1s. 3d. to 28s. 9d. after the meeting. English Electrics reacted to 20s. after having risen to 21s. on the expectation that the forthcoming accounts will show a healthy improvement in earnings. The company is saddled with a heavy carried-forward debit and, as a result of the decision two years ago to make the preference shares cumulative, with preference dividend arrears as well.

International Stocks

The American and Canadian Stock Exchanges received the new development in European affairs with considerably less equanimity than did the London markets. Except in the case of aviation and "armament" shares, prices gave way sharply before a fairly heavy wave of selling. Many prices have recovered from their lowest levels, but, on balance, declines are general. A strong advance in Hydro Electrics from 8⅜ to 9⅛ was halted abruptly, and the price fell back to 8¼. Brazilian Tractions partially collapsed under the selling pressure, losing 1¼ to 13⅜. International Holdings fell ¼ to 2½ in sympathy with Hydros and Brazilian Tractions. Radio Corporations had risen from 12 5/16 to 13 before dropping back to 12¼. Anglo-American Telegraph stocks are lower, but American Telephone and Telegraphs and Canadian Marconis resisted the general tendency. The former are a point higher at 172½; the latter are steady round 9s. Electrolux Corporations, with a fall of 2 to 24½, are brought nearer to the price of 23, at which they were introduced lately to the London market. A block of the shares has been placed more recently in Amsterdam at about 26½. Active dealing in Electric and Musical Industries has left the price unchanged on balance at 27s. 9d.

Miscellaneous Matters

Cable and Wireless stocks have participated in the general sentiment of the markets. Each of the three issues is lower. Globe Telegraphs, however, show no alteration. International Automatic ordinary have weakened to 46s. 3d. and the deferred to 45s. 6d. A florin fall in Telegraph Condensers left the price at 49s. 6d. As usual, the most spectacular movement in our price-lists is reserved for British Electric Traction deferred which, at 1450, is 115 points down. Some of the falls noted this week are due more to a precautionary lowering of the prices than to any real pressure to sell stock. On Tuesday evening a slightly harder tone became observable. Members of the House found that a few hardy bargain-hunters were asking for the offer of cheap securities, and a mild rally in prices followed this evidence of purchasing power on the part of the public.

Share List of Electrical Companies

	Nom.	Dividend. 1933.	Dividend. 1934.	Price Mar. 10	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3⅜	—	3 16 2
City of London	1	7½	7½	39/–	—	3 17 0
Clyde Valley	1	7	8	45/–	–1/–	3 11 1
County of London	1	10½	10½	56/–	–6d.	3 15 0
Edmundson's 7% Pref.	1	7	7	36/–	–6d.	3 17 9
Do. Ord.	1	7	8	45/–	–6d.	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/–	–1/–	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	65/9	—	3 7 0
Lancs Light and Power	1	7½	7½	39/–	—	3 17 0
Lond. Assoc. Electric	1	—	—	35/6	—	3 19 0
London Electric	1	7	8	40/–	—	4 0 0
London Power Deb. Red.	Stock	5	5	108½	—	4 12 2
Metropolitan	1	10	10	52/–	–6d.	3 17 0
Midland Counties	1	7	7½	39/6	–6d.	3 16 0
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	34/–	–6d.	3 10 7
Do. 7% Pref.	1	7	7	35/6	—	3 19 0
Northampton	1	10	10	53/9	—	3 14 5
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	58/9xd.	—	3 8 0
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	42/–	–1/9	3 16 2
South London	1	7	7	35/–	—	4 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/–	–6d.	3 9 7
PUBLIC BOARDS.						
Central Electricity 1950–70	Stock	5	5	116	—	4 6 2
Do. 1955–75	„	5	5	119xd.	—	4 4 0
Do. 1951–73	„	4½	4½	112	—	4 0 4
Do. 1963–93	„	—	3½	104	—	3 7 4
London Elec. Trans. Gtd.	„	—	2½	96½	—	2 11 10
London & Home Counties, 1955–75	„	4½	4½	113	—	3 19 8
London Passenger Transport, A.	„	—	4½	125½	—	3 11 9
Do. do. B.	„	—	5	127½	–1	3 18 5
Do. do. C.	„	3½	4	106	—	3 15 6
West Midlands Joint Elec. 1948–68	„	—	5	116¼xd.	—	4 5 10
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	172½	+1	5 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	124½	–1	4 16 5
Do. Def.	„	1½	1½	29½	–½	5 1 8
Cable & Wireless 5½% Pref.	„	2¾	4½	107½	–1½	3 16 9
Do. A. 7½% Ord.	„	Nil	Nil	27½	–1	—
Do. B. Ord.	„	Nil	Nil	8	–½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16¼xd.	—	2 3 4
Do. do. Pref.	10	6	6	14½xd.	—	4 4 3
Great Northern Tel.	10	20	20	43	—	4 13 0
Marconi-Marine	1	10	7½	35/–	—	4 5 9
Oriental Telephone Ord.	1	12	12	3¾	—	3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	„	5	5	1450	–115	—
Do. do. Pref. Ord.	„	8	8	179½	—	4 19 2
Brazil Traction	100	—	—	13⅜	–1½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	+1	5 0 6
Mexican Light Common	100	Nil	Nil	5½	+2	—
Do. 7% Pref.	100	7	7	6½	–1	—
Do. 1st Bonds	$500	5	5	47½	–10	—
Victoria Falls Ord.	1	20	20	3¾	–1/8	—
West Riding	1	5	6½	52/6	—	2 9 6
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	66/3	—	4 10 7
Assoc. Elec. Ord.	1	4	6	46/–	–½	2 12 2
Do. Pref.	1	8	8	38/–	–1/–	4 4 3
Babcock & Wilcox	1	6	8	54/6	–6d.	2 18 9
British Aluminium Ord.	1	5	7½	44/9	–1/6	3 7 0
British Insulated Ord.	1	5	15	5 1/8	—	2 19 3
Brush Ord.	Stock	Nil	Nil	44	—	—
Callender's	1	15	15	4½	—	3 12 10
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/–	—	12½	67/6	—	0 7 6
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	30/–	—	5 6 0
Electric Construction	1	Nil	3½	1 11/16	—	1 18 8
Enfield Cable Ord.	1	25	25	6¾xd.	—	3 18 5
English Electric	1	Nil	Nil	1	—	—
Do. do. Pref.	1	Nil	Nil	22/6	—	—
Ericsson Tel.	5/–	—	24	41/3	–1/8	—
Ever Ready	5/–	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	26/3	—	5 6 8
G.E.C. Pref.	1	6½	6½	34/–	—	3 16 6
Do. Ord.	1	8	10	77/–	–½	2 12 0
Henleys	1	30	30	7½	—	4 0 0
Do. 4½% Pref.	5	4½	4½	5½	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	46/3	–9d.	3 4 10
Siemens Ord.	1	6½	4	28/9	—	2 15 8
Telegraph Construction	£1	Nil	Nil	28/9	–1/8	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1934

14068. "Quenching of arcs." Schweitzer & Conrad, Inc. May 13th, 1933. (442709.)

14422. "Television." H. G. Lubszynski and S. Rodda. May 12th, 1934. (442666.)

17112. "Braun tubes." Radio-Akt.-Ges. D. S. Loewe. June 10th, 1933. (Cognate applications 17113/34 and 17114/34.) (442511.)

17419. "Scanning apparatus for television and like systems." C. O. Browne. June 12th, 1934. (442668.)

17660. "Magnetron oscillation generators." Marconi's Wireless Telegraph Co., Ltd., and W. E. Benham. June 14th, 1934. (442776.)

19604. "Cathode-ray tubes." A. C. Cossor, Ltd. July 22nd, 1933. (442513.)

19948. "Braun tubes." Radio Akt.-Ges. D. S. Loewe. July 8th, 1933. (Addition to 442511.) (442724.)

22909. "Variable self-inductance devices." G. Leithauser and H. Boucke. August 5th, 1933. (442673.)

22983. "Microphones." H. J. Round. August 8th, 1934. (442531.)

23046. "Synchronising arrangements for electric telegraphic systems." International Business Machines Corporation. August 9th, 1933. (442596.)

23056. "Wave-transmission networks." Standard Telephones & Cables, Ltd. (Western Electric Co.). August 9th, 1934. (442537.)

23150. "Electric braking apparatus for producing uniform rotary motion of a mechanism such as, for example, sound film apparatus." I. G. Farbenindustrie Akt.-Ges. August 19th, 1933. (442546.)

23175. "Cathode ray oscillograph systems." A. C. Cossor, Ltd., and O. S. Puckle. August 10th, 1934. (442548.)

23372. "Sound-receiving, sound transmitting, or sound reproducing means." F. R. Farrant and J. W. Blower. August 13th, 1934. (442678.)

23378. "High-frequency transmitting-apparatus." C. Lorenz Akt.-Ges. April 6th, 1934. (Cognate application 23379/34.) (442736.)

23416. "Electric insulating material and processes of forming the same." Westinghouse Electric & Manufacturing Co., Ltd. September 23rd, 1933. (442738.)

23434. "Electromagnetically operated or controlled impression mechanism for time-recorders." Telefonaktiebolaget L. M. Ericsson. June 6th, 1934. (442777.)

23437. "Wireless receiving apparatus." M. Gray. August 14th, 1934. (442739.)

23443. "Relaxation oscillation generator." Radio Akt.-Ges. D. S. Loewe. August 14th, 1933. (Cognate application 23444/34.) (442740.)

23474. "Very-high-frequency receivers." Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. August 14th, 1934. (442741.)

23596. "Electric-discharge devices." Siemens & Halske Akt.-Ges. August 15th, 1933. (442743.)

23754. "Automatic regulators for electrically effecting automatic regulation of a quantity, for example, a voltage." General Electric Co., Ltd., and J. W. Gibson. August 17th, 1934. (442679.)

23805. "Traffic-control systems." Siemens & Halske Akt.-Ges. August 17th, 1933. (442555.)

23973. "Electric circuit employing gas-filled discharge devices." General Electric Co., Ltd., and C. R. Dunham. August 20th, 1934. (442747.)

25032. "Production of magnetisable cores or krarup conductors from cold-worked magnetisable wires or bands." Siemens & Halske Akt.-Ges. September 29th, 1933. (442681.)

25033. "Lead storage batteries." Goodlass Wall & Lead Industries, Ltd., W. Singleton, Oldham & Sons, Ltd., and H. Holt, Jun. August 30th, 1934. (Addition to 411524.) (442558.)

26036. "Junction fittings for use in connection with electrical wiring conduits." Electric Supplies (Bloxwich) Ltd., T. Somerfield, F. Wooten and H. Garratt. September 11th, 1934. (442751.)

27121. "Electrical power systems and control arrangements therefor." F. A. Eastwood, and Associated Electrical Industries, Ltd. September 20th, 1934. (442560.)

27391. "Starting means for capacitor type single-phase induction motors." English Electric Co., Ltd., R. D. Ball and L. Roberts. September 24th, 1934. (442561.)

27640. "Luminous electric-discharge apparatus." Soc. Anon. pour les Applications de l'Eléctricité et des Gaz Rares Etablissements Claude-Paz & Silva. November 4th, 1933. (442563.)

27951. "Cathode-ray tube oscillograph arrangements." Marconi's Wireless Telegraph Co., Ltd., and A. J. Young. September 29th, 1934. (442682.)

29161. "Variable-coupling of electrical oscillatory circuits." Murphy Radio, Ltd., and H. D. Ellis. October 11th, 1934. (442685.)

29387. "Electrical oscillation generators." L. R. Merdler and Baird Television, Ltd. October 13th, 1934. (442686.)

31271. "Telegraph installations." Nationale Telephon-und Telegraphenwerke Ges. October 31st, 1933. (442613.)

31585. "Installation of electric-lighting dynamos on cycles." F. J. Miller. November 3rd, 1934. (442756.)

33905. "Operating dollies for electric switches." J. B. Tucker. November 26th, 1934. (442691.)

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2658. "Radio receivers for telephony, television and the like, in combination with counter or coin collectors." D. Mastini. January 26th, 1934. (442807.)

3322. "Masks for screens of cathode-ray tubes." General Electric Co., Ltd., and L. C. Jesty. February 1st, 1935. (442695.)

4479. "Removal of disturbances in high-frequency receiving apparatus." Ideal Werk Akt.-Ges. für Drahtlose Telephonie. February 14th, 1934. (442626.)

7781. "Plug coupling arranged in a box inserted in the roof." X. Kaeslin and R. Kilchmann. March 13th, 1934. (442812.)

11983. "Electrical systems of distribution." Humber, Ltd., J. E. P. Burge and E. A. Roughton. April 18th, 1935. (442640.)

11984. "Electrical systems of distribution." Humber, Ltd., J. E. P. Burge and E. A. Roughton. April 18th, 1935. (442641.)

15232. "Train-control systems." Lowee-Wintsch Automatic Train Control, Inc. October 13th, 1934. (442707.)

15699. "Electric cable connectors and enclosure casings therefor." V. Hope. May 30th, 1935. (442710.)

16317. "Terminals for electrical condensers." Plessey Co., Ltd. (Mallory & Co., Inc. P. R.). June 5th, 1935. (442646.)

16606. "Electric transformers." British Thomson-Houston Co., Ltd. June 9th, 1934. (442711.)

16817. "Portable electrically driven percussive tools." Siemens Schuckertwerke Akt.-Ges. June 26th, 1934. (Cognate application 16818/35.) (442822.)

16826. "Mounting of electrode systems in electron tubes." Egyesült Izzólámpa es Villa Mossági Reszvenytarsasag. June 11th, 1934. (442823.)

17826. "Arrangements for reducing ground noise in electro-optical sound-reproducing systems." Klangfilm Ges. June 27th, 1934. (442714.)

18286. "Magnetic circuit for transformers, inductance coils, and similar apparatus." Compagnie Electromécanique. July 12th, 1934. (442715.)

18437. "Indirectly heated cathode for electric-discharge tubes." Egyesült Izzólámpa es Villa Mossági Reszvenytarsasag. June 28th, 1934. (442649.)

20258. "Electric glow-discharge devices." S. H. William Jorgensen. July 16th, 1935. (442577.)

23564. "Electric switch with glow-lamp fitted into same indicating the location of this switch." H. Nabakowski. August 22nd, 1935. (442720.)

27097. "Transmitters for teleprinting machines." Siemens & Halske Akt.-Ges. October 5th, 1934. (442662.)

28838. "Electric hand vacuum cleaners." Siemens Schuckertwerke Akt.-Ges. January 10th, 1935. (42663.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 4th:—

Lorival. No. 565251. Class 1. Synthetic resins in liquid and powder form for use as ingredients in manufactures. No. 565252. Class 50. Moulding compositions made from natural and synthetic resins, waxes, shellac, wood flour, asbestos, kieselguhr, kaolin, french chalk, mica and slate flour, and electric insulating materials made from bitumen.—Lorival Manufacturing Co. (1921), Ltd., Norwood Works, Norwood Green, Southall, Middlesex.

Sinex. No. 563868. Class 6. Electrically driven vibrating motors.—Emile Damond, 28, Rue des Annelets, Paris. (British representatives: Mewburn Ellis & Co., 70-72, Chancery Lane, W.C.2.)

Fullway Mopump (lettering and design). No. 565544. Class 6. A pump and electric motor in combination.—Rhodes, Brydon & Youatt, Ltd., Gorsey Mount Street, Stockport, Cheshire.

Stadium. No. 561777. Class 8. Electrical accumulators and batteries (not for medical purposes).—Stadium, Ltd., 75-77, Paul Street, E.C.2.

Autricity. No. 565926. Class 8. Electric batteries (not for medical purposes).—Camillo P. Mortarotti, trading as "Autricity," 226, Whitehorse Road, West Croydon.

Rayweld. No. 564499. Class 13. Metal goods.—Trevithick Weld, Ltd., 55-58, Pall Mall, S.W.1.

Louverlux. No. 565348. Class 13. Fittings of ordinary metal for electric light reflectors.—Troughton & Young, Ltd., 143, Knightsbridge, S.W.1.

Very Low Temperatures Exhibition

In order to illustrate the principles underlying the attainment of temperatures lower than those produced by ordinary mechanical refrigeration and to show how substances are obtained in the three states of gas, liquid and solid, an exhibition was opened on March 4th at the Science Museum, South Kensington. It will remain open to the public until May 31st. Particular attention has been paid to illustrating their modern uses by over seventy exhibits, while historical apparatus has been got together from all parts of the world. With the production of solid helium in 1926, no gas remains that cannot be liquefied and solidified. A pamphlet giving a survey of the subject by Mr. T. C. Crawhall (secretary of the exhibition committee), is on sale at 6d. Among the illustrations is a chart showing the boiling, freezing and critical points of the constituents of the atmosphere. At the opening ceremony Lord Rayleigh presided in the absence, through illness, of Col. Sir Henry Lyons. Sir William Bragg deprecated the view that a science museum merely recorded the achievement of thought and inventions in the past. Its duty was to show the continuous progress of science and its applications to national welfare and security. The construction of the machinery necessary to reach very low temperatures had developed a new and important technique. Nothing but the demonstration of the actual machinery at the exhibition and the explanations given by those in charge of it could make one appreciate the queerness of the methods that had proved to be the most efficient. Liquid oxygen was now produced in large quantities because it was easily transported and had many industrial applications. A vote of thanks to Sir William Bragg was proposed by Mr. H. T. Tizard (chairman, Exhibition Committee) and seconded by Col. Mackintosh (director of the Science Museum).

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashford (KENT).—Houses (70), A. F. Webster, U.D.C. surveyor, 5, North Street.

Audenshaw (LANCASHIRE).—Houses (24), Booth House estate, for E. V. Fitton, Flixton.

Bacup.—Fire station, Burnley Road; borough engineer.

Bangor (NORTH WALES).—Isolation hospital; city architect, Town Hall.

Bedford.—Church, London Road estate, for the Methodist trustees; secretary.

Bilston.—Factory, Hoxdale estate, for B. Gethings and Son.

Birkenhead.—Technical college, for E.C.

Birmingham.—Clinic, Highfield Road, Yardley Wood; J. Emlyn Williams, builder, Victoria Road, Birmingham. Secondary school, Perry Barr (£56,600), for E.C. Rebuilding C. & A. Modes, Ltd., Corporation Street (£40,000), with electrical work; B. Whitehouse & Son, builders, Monument Road.

Blackpool.—Houses (51), Carlisle Avenue; R. Fielding & Son.

Blyth.—Houses (335) in connection with slum clearance schemes, and four schools, Kitty Brewster, Plessey Road. Newsham and a nursery school, and also extensions to the New Delaval Senior school; L. Leeper, borough engineer.

Boston.—Houses (48); R.D.C. surveyor.

Bradford.—Shops, Central area; city architect.

Bristol.—Houses, Horfield and Ham Green, for C.C.; city engineer, Bristol.

Bury.—Houses (232) and shops, near Radcliffe Road; Teasdale & Sunter, architects, 4, St. Mary's Parsonage, Manchester. Technical college (£100,000); director of education.

Carmarthenshire.—Junior and infants' school, Llwynhendy, Llanelly; county architect.

Chesterfield.—Houses (74), Boythorpe Road; borough surveyor.

Crook (Co. DURHAM).—Houses (94), for the North-Eastern Housing Association, Ltd.; E. W. Ayton, surveyor, Crook U.D.C., Council Offices, Crook.

Cuckfield (SUSSEX).—Houses (30), Haywards Heath; G. Plummer, U.D.C. surveyor, Oaklands, Boltro Road, Haywards Heath.

Dagenham (ESSEX).—Houses (1,112), Heathway Park estate, for Wates (Streatham), Ltd., 98, London Road, Mitcham.

Darlington.—Houses (106) for rehousing purposes; Housing Committee.

Dewsbury.—Houses, Earlsheaton, and Dewsbury Moor (296); borough architect.

Dudley.—Hotel, Wren's Nest Road; Mitchells & Butlers, Ltd. Shops and flats, 84-7, High Street; A. Preedy & Sons, Ltd. Zoological Gardens, Dudley Castle: Zoological Society.

Dursley (GLOUCESTERSHIRE).—Houses (70), for Housing Committee.

Eastleigh.—Central premises for the Eastleigh Co-operative Society, High Street.

Edinburgh.—Public hall; city architect.

Folkestone.—Houses (67), Hill Road estate; borough surveyor.

Gateshead-on-Tyne.—General hospital; borough engineer.

Glasgow.—Baths, Glasgow Green (£70,000); city engineer and electrical engineer.

Guildford.—Cinema, Worplesdon Road, Stoughton, for R. C. Whitemore.

Hastings.—Cinema, Cambridge Road, for the Union Cinema Co., Ltd., 167, Wardour Street, London, W.1.

Hayes (MIDDLESEX).—Houses (113), Yeading Lane; L. Warren.

Hove.—Flats (258), Furze Hill, for Toms & Partners.

Hull.—Houses (306), North Hull estate; Sims, Sons & Cooke, Nottingham.

Ilkeston.—Bus depôt, Manor Road; Barton Transport, Ltd. Extensions to factory, Awsworth Road; A. Booth & Sons.

Isle of Axholme.—Houses (22); R.D.C. surveyor, Queen Street, Epworth.

Isle of Wight.—County offices, Newport; R. F. Gutteridge, architect, 9, Portland Street, Southampton.

Kendal.—Houses (114); F. W. Oxberry, borough surveyor.

Keymer (SUSSEX).—Houses (1,400); G. E. Ferguson, Hassocks.

Lancashire.—Hostel, &c., Farm Colony, Hutton (£30,265), and extensions to hospital (£44,363), Biddulph, for C.C.

Leeds.—Houses (26), Fairfax Road; city architect. Schools, Gipton housing estate, for E.C.

Lichfield.—Houses (40); L. Straw, R.D.C. surveyor.

London.—(BERMONDSEY).—Extension to Peak Frean & Co., Ltd. (£80,000). (HAMMERSMITH).—Nurses' home, for the Royal Masonic Hospital, Ravenscourt Park, W.6. (POPLAR).—Tenements, Amias Place and Gaselee Street (£38,000); L.C.C. architect. (ELTHAM).—Extensions to factory, for W. Grafton & Son, Ltd., 122, Foots Cray Road, S.E.9.

Lynton (DEVONSHIRE).—Isolation hospital; U.D.C. surveyor.

Mirfield.—Club premises; Firth, Son & Blackburn, architects, 22, Wellington Road, Dewsbury.

Newcastle-on-Tyne.—Exhibition hall, Walker, similar to the Olympia for a London syndicate; Sir Charles Allom, architect, 5, George Street, Hanover Square, London, W.1. Factory, Walker Road, for George Angus & Son, and showrooms, Blenheim Street, for E. Baker & Co.; Stanley Miller, Ltd., builders, 17, North Street. Town hall, Jesmond Road; city architect.

Newcastle (STAFFORDSHIRE).—Houses (32), Alsagers Bank; R.D.C. surveyor.

Newport (MONMOUTHSHIRE).—Houses (111), Maesglas; E. F. King & Co., builders, Turner Street.

Northamptonshire.—Four schools and extensions to Kettering and Rushden institutes for County E.C.

Northern Ireland.—(BELFAST).—Elementary school (800 places), Orangefield estate, for E.C. Additions to Ulster Hospital for Women and Children, Templemore Avenue; Tullock & Fitzsimons, architects, 58, Howard Street.

Oldham.—Converting Palace Theatre into cinema for the Odeon Theatres, Ltd., Cornhill House, Bennetts Hill, Birmingham; P. Hamer, Ltd., builders, Park Street, Swinton, Manchester.

Oxford.—Houses (115); James Bros., Chickerell Road, Weymouth, builders.

Portsmouth.—Extensions to factory, Aerodrome; Airspeed, Ltd.

Port Talbot.—Houses (43); clerk, Municipal Buildings.

Romford.—Cinema, Collier Row; J. Smith.

Rowley Regis.—Houses (192), Grace Mary estate; borough housing architect.

Sale.—Extensions to Town Hall; borough surveyor.

Salford.—Public baths, Great Clowes Street (£100,000); city engineer.

Scarborough.—Elementary school, Northstead estate; borough engineer. Estate development, Westwood; F. R. Walshaw.

Sedgefield.—Church, Fishburn; Hays & Gray, architects, Central Chambers, Wingate (Co. Durham).

Skegness.—Extensions to Cottage hospital (£20,000); secretary.

Southall.—Factory, Kingsbridge Crescent; Property Development & Construction Co., Ltd., Lady Margaret Road. Factory, Uxbridge Road; Joinery & Building Supplies, Ltd., Victoria Works, Edgware Road, N.W.2.

Southend-on-Sea.—School, Lifstan Way (200 places); H. Boyes Watson, director of education.

South Shields.—Isolation hospital in the grounds of Harton Institution; J. Reid, borough engineer.

Stretford.—Houses (38), Norwich Road; Albert Locke, Ltd. Cinema, Chester Road; Union Cinema Co., Ltd., 167, Wardour Street, London, W.1. Estate development near Barton Road; J. Maunders & Sons.

Sunderland.—Houses (47), Thompson Road; J. Potts & Sons, architects, John Street. Nurses' hostel to the Municipal Hospital (£25,000); borough engineer.

Swansea.—Grammar school (£80,000), for Borough E.C.; Ernest Morgan, borough architect.

Taunton.—Cinema, Station Road (electrical work); W. H. Watkins, architect, Bristol.

Tonbridge.—Houses (20); W. N. Miller, R.D.C. surveyor, 48, Pembury Road.

Tottenham.—Odeon cinema, High Road (£60,000); G. Coles, architect, 40, Craven Street, London, W.C.2.

Tunbridge Wells.—Cinema, for the proprietors of the Ritz Cinema.

Warrington.—Houses (100), Alder estate (£31,784); J. Dolan & Sons.

Watford.—Extensions to factory, St. Albans Road; Petrolflex Tubing Co.

Wednesfield.—Houses (2,000), Perry Hall estate, Stubby Lane and Broad Lane, for E. A. Coleman, 39, Newhall Street, Birmingham; Skelcher, Machin & Watson, architects, International Exchange, 156, Edmund Street, Birmingham.

Welwyn Garden City.—Factory for Murphy Radio, Ltd., Broadwater Road.

West Hartlepool.—Bus station, for the United Automobile Services, Ltd., Grange Road, Darlington.

Westhoughton.—Houses (40); U.D.C. surveyor.

West Riding.—Technical institute, Wombwell, for County E.C.; education architect, Wakefield.

Wolverhampton.—Houses (166), Green Lane; Brian Construction Co., Ltd. Cinema, Cannock Road; Salberg & Clift. Cinema, Garrick Street; Associated British Cinemas, Ltd., 30, Golden Square, London, W.1. Cinema, Penn Road; Whitehouse & Grindley.

Worcestershire.—School (300 places) Halesowen; director of education, Worcester.

Worthing.—Houses (30), Hollingbury Avenue; H. W. Adams, Ltd.

The World Power Conference

We have received from the British National Committee of the World Power Conference a programme for the assembly in Washington from September 7th to 12th. This sets out the history and objects of the Conference and gives brief details of the matters suggested for discussion in each of the seven sections which are:—Physical and statistical basis of the national power economy; organisation of the fuel industries; organisation and regulation of the electrical and gas utilities; national and regional planning for the most efficient utilisation of natural resources; special problems in regional planning; rationalisation of distribution; and national power and resources policies. After the Conference there is to be a three weeks' transcontinental tour. The Electrical and Engineering Papers Committee consists of the following:—Mr. Roger T. Smith (chairman), Sir Harold Hartley, Col. J. G. Fleming, Mr. E. E. Hoadley, Sir Cyril Hurcomb, Mr. J. M. Kennedy, Sir Archibald Page, Mr. C. Rodgers and Mr. C. D. Taite. Intending participants in the Conference or the concurrent Congress of the International Commission on Large Dams should apply for particulars as soon as possible to the office of the British National Committee, 36, Kingsway, London, W.C.2.